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ABSTRACT

A study identified, measured, and evaluated factors that determined students' entrance into and progress within apprentice training programs, and made policy recommendations pertaining to linkages between vocational education and apprenticeship programs. Three different methods of assessment were used in the study. The primary instrument was a 25-item apprenticeship survey that was completed by 628 first-year apprentices--320 carpenters, 265 machinists, and 43 auto mechanics. It contained questions regarding the apprentices' personal and educational background, trade-related experiences, and sources of information on apprenticeship. In addition, telephone interviews were conducted with 49 of the original 628 respondents and personal interviews were conducted with 21 employers who employed one of the apprentices interviewed by phone. Topics covered in the phone interviews included respondents' motivations for becoming apprentices as well as their evaluations of their high school experiences. While the employer interview focused mainly on ratings of individual apprentices, it also included questions concerning apprentices in general. Based on data from the three instruments, researchers made 17 recommendations pertaining to topics such as steps students can take to gain entrance into apprenticeship programs and the educational needs of students planning to become apprentices. (MN)

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FINAL REPORT

An Exploratory Study of Vocational Education Enrollment and Appreticeship

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I. Executive Summary

A. Major Findings and Conclusions

The following is a series of capsule summaries of the major findings. They are presented in the order in which the results appear in this report.

- Apprentices in all three trades were nearly all white males between 18 and 29 years old, single with no dependents.
- At the time of their entrance into apprenticeship, few were union members but over half were employees of the company where they were apprenticing. Many became union members during apprenticeship.
- Apprentices were almost equally representative of academic, vocational, and general education high school programs although percentages varied by trade. Over half of the machinists were from vocational education programs.
- All but 3% of the apprentices said that they had received at least a high school diploma. Over one-third of them had taken courses at business or trade school, community college, or college.
- Most apprentices reported having received A or A-B grades in math and apprenticeship courses and slightly lower grades in English. In general, apprentices were inclined to rate their math ability higher than their reading ability.
- Most apprentices' parents were high school graduates, and about one-quarter of the fathers had further education. The largest group of fathers were craftsmen, and most mothers were homemakers.
- Over half of the apprentices said that they had received occupational training prior to apprenticeship.

- Nearly all apprentices had spent some time working while in high school, and over one-half of them had had three or more years of work experience since high school. Only one-quarter of them had no trade-related work experience prior to their apprenticeship.
- Apprentices had spent an average of four hours per week in trade-related hobbies while in high school and seven hours per week after graduation. Only about 10% of the apprentices had ever been involved in any trade-related clubs.
- Nearly one-third of the apprentices had friends or relatives in the same apprenticeship program. Parents, other relatives, friends, vocational education teachers, and counselors were all useful sources of information about the trades during high school. After high school, company notices, brochures, and company representatives served as useful information sources. For Carpenters, information received from unions was important.
- In general, apprentices had received some or a great deal of accurate information about most aspects of their trade. The areas in which they were least knowledgeable were opportunities for promotion, apprenticeship duties, responsibilities, and working conditions.
- Most apprentices were attracted to a program because it offered opportunities for training and jobs, although most were already employed.
- Parents and others who encouraged apprentices to pursue trades gave nonspecific advice in that they did not direct them into a particular apprenticeship program. Nearly half of the apprentices had been advised to enroll in college.

- In general, apprentices were confident that their employers would give them the job performance ratings that they deserved. Most apprentices felt that they were above average in attendance, getting along with co-workers and supervisors, and their use of safe work practices. There were only two areas in which more than 10% of the apprentices felt that they were below average: knowledge of technical information and amount of supervision needed.
- Although there were variances by trade area, the majority of apprentices viewed their working conditions and their employer's attitude as above average to excellent. One-third of them saw their pay as below average. Apprentices were generally pleased with their work assignments and the level of instruction that they were receiving in class. However, only half of them judged classroom instruction to be relevant and the tools, equipment, and materials used in the classroom to be similar to those used on the job.
- In general, there was a great deal of correspondence between the ratings that apprentices expected and their employers' actual ratings of them when the percentages of people choosing each rating were compared. However, neither the overall ratings of apprentices nor their employers were varied enough to establish the precise degree of relationship in terms of a correlation coefficient.
- Over half of the employers felt that apprentices need improvement in basic English and math even though apprentices judged themselves to be above average in these areas.
- Apprentices who did above-average work in apprenticeship classes also demonstrated above-average knowledge of their trade and good work attitudes while on the job.

- Employers reported quitting as the most typical reason for employee termination, followed by lay-off. Reasons given for quitting were varied although it was almost never because the apprentice felt the training was not adequate. Although firing was uncommon, the reason for firing was more often inadequate job performance than unacceptable work habits or attitudes. However, improper attitude and domestic problems were frequently cited problems for many employers.
- Most academic and general education students did not receive trade information from high school vocational education teachers. In addition, vocational education students received trade information from their parents and high school counselors more often than their peers.
- Many of the academic students who entered apprenticeships had fathers who had attended college and may have encouraged them to go to college. Although a large percentage of the apprentices who had been academic students attended college, very few finished with degrees.
- Apprentices from academic programs had higher verbal ability than their peers (as measured by self-reported English grades), but they were comparable to vocational education students with respect to grades in math courses. Apprentices from academic programs were the most likely to report their ability in reading and math computation as above average or excellent.
- The performance of vocational students in apprenticeship classes was similar to that of academic and general students (as measured by self-reported grades). This may be because many nonvocational students received occupational training on the job and from other sources prior to apprenticeship.

- Machinist apprentices from vocational education programs were able to enter apprenticeship at an earlier age and with less work experience than their peers. Not only were they younger, but few had any dependents.
- Machinist apprentices with a vocational education background were most inclined to rate themselves as above average in the accuracy and quality of work, technical knowledge, attendance, and relationship with supervisor.
- While Machinist apprentices from vocational education programs rated their working conditions as above average, those from academic programs felt their working conditions were poor. It is interesting to note that those from academic programs were also more likely to be union members.
- Carpenter apprentices from academic programs view themselves as superior to their peers with respect to the classroom part of apprenticeship.
- The high school courses that apprentices found to be most helpful for gaining acceptance into the carpentry and machinist trades were math and vocational courses such as carpentry, drafting, machine shop, and welding. Some felt that college preparatory experience was helpful but wished that high school personnel had provided them with more information about careers in the trade areas rather than steering them into college and white collar jobs. Apprentices saw a need for improvement in the quality and variety of vocational education programs, including on-the-job experience.

There were also a number of interesting findings derived from building models of determinants of apprenticeship achievement for Carpenters, Machinists, and academic, vocational, and general high school background apprentices:

- Younger apprentices and those with lower verbal ability had had more exposure to trades in high school than other apprentices. They had received information from more sources and had spent more time in clubs and in pursuing trade-related hobbies than older apprentices.
- Verbal ability (English grades and reading ability) was found to be an important determinant of apprenticeship performance both in the classroom and on the job. This was particularly true for Carpenter apprentices and those from academic backgrounds.
- Trade-related high school experiences and exposure to trade information were also found to be important determinants of apprenticeship performance, both in courses and on the job. These high school experiences were more important predictors of job performance for apprentices with vocational backgrounds than they were for those with academic backgrounds. Carpenters were an exception in that high school experiences were not strong determinants of their later achievements.
- While it was found that any type of work experience was an important predictor for Machinists, trade-relevant work experience was critical for Carpenters.
- Among Carpenters, those with more dependents had higher job performance ratings. This finding suggests that maturity is related to this group's success on the job. However, younger Carpenters received higher grades in apprenticeship courses, perhaps because they were more accustomed to the classroom environment.

- Apprenticeship grades were closely related to performance on the job for both Carpenters and Machinists. This relationship was strongest for apprentices from vocational backgrounds.
- Apprenticeship classroom performance and program rating were negatively related for Machinists; that is, apprentices who performed better in class were less pleased with their program. This was also true for Carpenters with high verbal ability. Perhaps these apprentices did not find their programs challenging enough or they simply had incorrect expectations.
- Where there was a relationship between job performance and program rating, it was a positive one. Apprentices who were doing better on the job had a higher opinion of their apprenticeship program.
- Job performance was more predictable from the variables included in this study for apprentices from academic backgrounds than it was for those from vocational programs. This suggests the need to study other aspects of the vocational high school program as possible predictors of apprenticeship performance.

B. Improving the Linkages of Apprenticeships

The recommendations presented in this section are based on the major findings of the study. Because results varied quite a bit between Carpenters, Machinists, and Auto Mechanics as well as between the three high school program areas, it is important to realize when it is appropriate to generalize across groups and when each must be considered separately. However, for summative purposes, most of what follows are general recommendations, with only occasional mention of particular high school or trade groups.

- Youth who want to get into an apprenticeship programs should try to get jobs (even on a temporary or part-time basis) at companies that have apprenticeship programs because many employers select new applicants from a restricted pool of their own employees. While getting any type of work experience in high school is helpful, most new apprentices have had trade-related work experience as well.
- Youth should be encouraged to spend more time involved in trade-related hobbies and clubs. VICA and other vocational clubs could provide exposure to potential employers.
- Greater attention should be given to integrating females and nonwhites into apprenticeships and confronting sex and race bias that may exist among certain employers.
- Because some students may have an unfair advantage in getting into apprenticeship because of nepotism and because they have friends in the trade, it is important that parents, vocational teachers, and counselors do as much as possible to help deserving students get jobs and entrance into apprenticeship. More information should be solicited from companies and trade unions by school personnel so that all students (not just those with contacts) can learn about opportunities in the field.
- Lectures and literature about apprenticeship programs should include realistic information about the job duties, responsibilities, and working conditions of the typical apprentice, as well as the pay and opportunities for promotion.
- Parents should be educated about the careers that their children could have in various trade areas. Descriptive information about various

trades and information about which trades have job openings, which skills will be in demand in the future, and so forth would enable parents to help their children decide which trade area they would like to pursue.

- The information dissemination activities of the State Apprenticeship Council should be expanded.
- Apprentices' classroom instruction should be evaluated in order to determine whether it is relevant and whether the tools, equipment, and materials are up to date and similar to those used on the job. Instruction should focus on obtaining technical information and developing the ability to work independently, with minimal supervision.
- High schools should do their best in preparing students in all programs with basic English and math skills. These skills are highly valued by employers in the trades.
- High school teachers and counselors might prevent future job failures by helping students develop positive work attitudes and stressing the importance of preventing personal problems from interfering with their employment situation.
- Teachers, counselors, and parents should provide nonvocational students with trade information so that they can make intelligent career decisions and will be provided with options other than attending college or seeking white-collar jobs.
- Vocational high school students are less confident in their reading and math computation abilities than their academic peers, but they report similar math grades. The vocational curriculum should include emphasis on verbal and math skills.

- There is a demand for a greater variety of vocational education programs and for an improvement in the quality of the programs. One improvement might be that of offering cooperative education or some on-the-job experience to students while they are still in school so that they can be directly exposed to trades.
- While it is important that future machinists get any type of work experience, it is critical that the students who want to become carpenters get trade-relevant work experience.
- Because apprenticeship class performance is closely related to performance on the job, it would be beneficial for the curriculum in vocational education programs to correspond as closely as possible with the local apprenticeship program curriculum. However, the latter program should build upon the former, so that it remains challenging to the better students.
- Performance on the job is an important determinant of the apprentice's satisfaction with the program. Therefore, it is critical that supervisors provide feedback to apprentices regarding their performance and provide assistance so that they can progress.
- Future studies of the factors that lead to successful apprenticeship performance should explore specific aspects of the vocational high school program. The factors that predict future on-the-job performance for academic and general students are different from the predictors for vocational students.

II. Introduction

A. Purpose of this Study

The broad goal of the study was to identify, measure, and evaluate the indicators (determiners) of entrance into and progress within apprentice training programs and to make related policy recommendations. Specific objectives included:

(1) identifying the independent, predictive and/or explanatory variables that contribute to acceptance into and success in apprentice training programs;

(2) comparing graduates of vocational education programs and other groups in terms of entrance and success variables;

(3) examining the extent to which apprenticeship and vocational education programs are competitive or complementary;

(4) investigating ways of improving linkages between vocational education and apprentice training programs;

(5) determining which, if any, aspects of the vocational education program need to be modified to improve vocational education graduates' entry into and success in apprentice training programs.

B. Related Research

A review of the literature on apprenticeship was conducted in order to provide a foundation upon which to build the present study. This literature review will provide interested readers with a background in apprenticeship research that should aid them in their comprehension and interpretation of this report.

Much has been written on the history, progress, and nature of the apprenticeship system in America, especially since the 1960s, the "era of the manpower revolution." Following the enactment of extensive manpower legislation in the early 1960s, the latter half of the 60s and the 70s saw the undertaking of numerous studies to investigate aspects of apprenticeship such as training, performance of graduates, apprenticeship vs. non-apprenticeship paths to the trades, and so forth. Several hundred articles documenting these studies and the recommendations that were made can be found in the files of the National Technical Information Service and the Educational Research Information Center. (Both of these sources were used in researching the studies relevant to the purposes of the present study.) One excellent bibliography was found in the Illinois Apprenticeship Study, 1976. This study lists approximately 100 articles, pamphlets, and books, and each citation is accompanied by a short description.

With regard to the goals of the present study of Pennsylvania apprentices, however, relatively little research has focused on paths of entry to apprenticeship programs or success within the first year. And while there has been considerable discussion in the literature of the vocational education/apprenticeship linkages, divergences, and tensions, little research was found that was related to the specific concerns of this study. As a result, bits of information from a variety of studies have been pieced together to try to provide the framework for this research. Literature will be discussed under the following categories: (1) general methodology and adequacy of data sources; (2) entrance to apprenticeship; (3) success in program; and (4) vocational education and apprenticeship.

1. General Methodology and Adequacy of Data Sources

Most studies of apprenticeship have been conducted on a state or regional basis and have relied on data collection techniques such as mail questionnaires and interviews of apprentices. The reasons for evolution of this approach to apprenticeship become clear as one begins to review the nature of the frustrations encountered in attempting to study the complex nature of the apprenticeship system in the United States.

Since passage of the National Apprenticeship Act of 1937, the program of federal regulation of the apprenticeship process has been administered by the Bureau of Apprenticeship and Training (BAT) of the United States Department of Labor. Although BAT issues the minimum standards for federal approval of state programs and collects data on the programs that choose to register with them, the apprenticeship system varies considerably from trade to trade among states, and within states from local area to local area, depending on labor conditions and the nature of the collective bargaining process between unions and employers.

As a result of these variations and the fact that many of the apprenticeship programs in the United States are not even registered, there has been a general absence of relevant data on apprentices and extensive deficiencies in the data that do exist. In the proceedings of a 1974 Conference on Apprenticeship held as part of the Industrial Relations Research Association's (IRRA) twenty seventh annual conference, Robert W. Glover, in a paper entitled "Apprenticeship in America: An Assessment", discussed trends in apprenticeship and critiqued the available data sources. Looking at various follow-up studies on apprentices, Glover decided that there is a long-run trend for an increasing proportion of craftsworkers to come through apprenticeship and that a substantial percentage of apprenticeship-trained workers advance to managerial and entrepreneurial positions. Unfortunately, however, data sources are poor. BAT data cover only registered programs, and 1974 estimates were that anywhere from one third to one half again as many programs went unregistered. Available BAT data did not include data on characteristics of apprentices. EEOC data on participation of minorities were collected only for apprenticeship programs serving 25 people or more and were not comparable from year to year. Census data are collected only once every 10 years and do not probe for details of work; unless the respondent happens to say that he or she is an apprentice, this information is not collected. Unions generally lack the funding and staff necessary to conduct research on apprenticeship issues, and union files tend to remain largely inaccessible to non-union researchers and others. The quantity, quality, and organization of information available in regional and local BAT and SAC offices vary considerably. No standards for record keeping seem to apply, and, as a result, data in some offices were so incomplete or badly organized as to make them almost useless.

Glover concluded that in view of the fact that training through apprenticeship appears to be so effective and successful, and yet so little understood, it is particularly disappointing that data sources on apprentices are so inadequate. This point was echoed in other papers presented at the IRRA conference (Barocci, "Wage Variations among Former New York Apprentices," and Roomkin and Hansen, "Implications of Foreign Training Practices for American Apprenticeship"). Howard G. Foster, the discussant, concluded that, as a result of the poor data, much of what passes for "knowledge" in this field is derived from desultory observations of practitioners or from scholarly research based on limited and questionable samples; generalizations are made on the basis of inquiries constrained by available data or by the professional interests of the researcher. While this 1974 conclusion was rather severe, it appears that at the present time the situation with respect to adequacy of and accessibility to data sources remains much the same as it did seven years ago. For these reasons, the present study of Pennsylvania apprenticeship, while attempting to use available records, was forced to rely heavily on data gathered from questionnaires and interviews in much the same manner as other studies. Data analysis in the present study, however, was more rigorous than that of many of the other studies. (The specific methodology used in the present study is described in the next section of this report.)

The study of apprenticeship on a state, regional, or even local basis has its foundation in the aforementioned problems with data sources, the extreme variability in operation of apprenticeship systems, and the nature of local concerns. In 1975, A Pilot Study of the Apprenticeship System set out to determine whether a national survey of apprenticeship practices could be conducted at a reasonable cost and produce useful and generalizable results. A pilot-test study, including a mail survey, personal interviews for attitudinal indicators, and a case study (due to high non-response rate), was conducted in California and Rhode Island. Problems encountered included lack of union cooperation, major delays in probing responses at the local level, and scattered, highly inaccurate records. The conclusion was that a national study was not feasible and that even in local studies union cooperation and local labor market data are a necessity. Since the apprenticeship system is a private one and union officials and other administators are under no obligation to provide data about their programs, expensive and time-consuming techniques are often necessary to collect data.

While the local approach to the study of apprenticeship may be the only feasible one at the present time, it tends to result in some confusion of findings and prevents generalization to other studies. One example of this confusion was the differences found in the personal characteristics associated with program completers and dropouts. Many personal characteristics have been thought to be associated with program completion, including age, marital status, experience, sources of advice and information, and so forth. Some studies have found age to be associated with completion; others have not. The same is true for other personal characteristics.

Because of the difficulty in selecting specific characteristics as established indicators of successful entry into apprenticeship programs and success in the first year, the characteristics used in the other studies reviewed have been carefully evaluated, first by ETS and then with the project advisory committee and the project officer. After a final selection of appropriate indicators, questionnaire items were drafted to reflect the needs of the Pennsylvania study.

2. Entrance to Apprenticeship

A comprehensive overview of the subject of apprenticeship is contained in the chapter on apprenticeship in Levitan, Mangum, and Marshall, Human Resources and Labor Markets, 1972. In their discussion of entry qualifications for apprenticeship programs, the authors make the observation that, because of the significance for manpower policies as well as discrimination, apprenticeship admissions qualifications, standards, and procedures will remain controversial for some time. These qualifications and standards vary considerably, and there is no objective evidence concerning their relevance. When resolution occurs, it will probably be in terms of agreement on the mechanisms for determining qualifications and standards rather than the precise determination of the qualifications themselves.

More detailed information on the variety of admission qualifications and standards can be found in Robert W. Glover's recent paper, Apprenticeship in the United States: Implications for Vocational Education Research and Development, 1980. Glover discusses the considerable diversity in admissions requirements and makes the following generalizations:

- Age and Maturity - Although BAT procedures specify a minimum age of 16, the official minimum tends to be 17 or 18. In practice, youngsters of minimum age face increasing competition from older workers in getting admitted into apprenticeship. Most programs have dropped maximum-age restrictions (previously set at 24 or 25) because of pressure from recent court decisions. Veterans and married men are favored because of greater stability in work habits perceived to be associated with experience and family responsibilities.
- Academic Requirements - For most programs, a high school diploma or the equivalent is required for admission. Electrical and sheet metal programs often add special math course requirements. Other programs add other special requirements.
- Written Tests - Applicants generally must take written examinations. Traditionally the Joint Apprenticeship Councils (JAC) have constructed and administered their own tests, but there is a trend toward the use of standardized tests that have been validated as job related under EEO requirements.

- Oral Interview - Almost all apprenticeship programs use an oral interview, generally administered by the JACs or program sponsor, to determine an applicant's interest in the trade and whether he or she is likely to complete it successfully. "Social acceptability" is sometimes a part of the evaluation made during the interview, in addition to potential productivity.
- Restricted Pool - Many apprenticeship programs select from a restricted pool of existing employees. The exact number is unknown, but Glover estimates that about one third to one half of all programs operate this way (most appear to be concentrated in manufacturing).
- Other - Apprenticeship programs generally open only once or twice a year for a few weeks. The number of openings varies from trade to trade and city to city. Often there are many applicants per opening. While Glover is not explicit on this point, it is obvious that one must know about the openings in order to make application.

A 1973 study by Swanson, Hernstadt, and Horowitz, The Role of Related Instruction in Apprenticeship Training (A Pilot Study), provides some data from Boston trades to support the speculations made by Glover. Specific data on hiring qualifications for operating engineers and machinists indicate that high school diplomas, aptitude tests, interviews, and requirements of being an employee of the firm were important factors. The Operating Engineers JAC had a specific set of weighted qualifications, which included physical ability (10%), previous work experience (10%), military service (10%), satisfactory verification of character and work history (10%), mechanical and technical subjects (5%), high school education or equivalent (10%), passing the GATB aptitude test (15%), appearance and character (15%), and motivation and attitude (15%). Applicants had to score 70% or better to be placed on the eligibility list and were ranked by score. The application was only good for one year. In the machinists trade, 17 companies were surveyed about their hiring qualifications and sources of apprentices. Minimum age, high school diploma, passing an aptitude test and interviews were mentioned by individual companies. Machine courses, demonstration of manual ability, mechanical aptitude, and mathematical aptitude were also mentioned by various companies in addition to a frequent preference for vocational school graduates and an occasional requirement that the candidate be a company employee.

Aside from the Swanson study, however, little explicit hiring qualification data were found. To get some idea of the kinds of people in apprenticeship programs, most of the studies relied on apprentice profiles obtained through mail questionnaires and interviews. The reasons for this kind of approach have already been discussed. For the present study, hiring practices were reviewed for the Pennsylvania trades selected, but mail questionnaires and interviews were also relied on heavily.

3. Success in Program

A number of studies investigating comparisons between apprenticeship completers and dropouts in different states have been conducted. The studies are mainly descriptive and, depending on the goals of the research, they consider a variety of factors that can be subsumed under the following categories: personal characteristics of apprentices; influence of occupational trade; degree of employer satisfaction with the working conditions of the apprentice program; and local labor market conditions.

While data were reported for some of the factors in the categories mentioned, relationships between categories or factors were not systematically studied, nor did studies always obtain the same results regarding the significance of individual factors on apprenticeship completion.

No information at all was found on the extent to which graduates of vocational programs completed apprenticeship programs or their success in the first year of the program. The concept of success in an apprentice program was primarily studied in terms of the apprentice's decision to leave, not in terms of the apprentice's success in meeting the employer's expectations. The only data found on an apprentice's success in meeting the employer's expectations were in some of the reasons given for cancellation of indenture, and these data were insufficient as a basis for further investigation.

In 1970, a comprehensive study was initiated on the training and work experience of completers and dropouts from registered apprenticeship programs in New York State. The period of study was 1958 to 1969. Questionnaires were mailed to 38,500 former apprentices out of a total population of approximately 70,000, and 9,350 usable responses were received. Trades studied included the three trades surveyed in the present study. The report, entitled Training and Work Experiences of Former Apprentices in New York State, 1975, contains some interesting comparisons between completers and dropouts. Sixty percent of the New York apprentices completed their training, while 40 percent did not. In 1971, the year following the period under study, nearly 90 percent of the completers and 46 percent of the non-completers were employed in apprenticeship craft trades, most of them in trades highly related to the field in which they served their apprenticeship. Of those working in highly related trades, only about 1 percent of the completers and 16 percent of the dropouts were working below the journeyman level. Seventy-three percent of apprenticeship dropouts apparently quit the program voluntarily, while seventeen percent said the employer was responsible, and ten percent were inducted into the armed forces. Completers were older, had more preapprenticeship job-related courses and more job experience prior to apprenticeship than dropouts.

A few years later at the 1974 IRRA conference, Thomas Barocci reported, in a paper entitled "Wage Variations Among Former New York Apprentices," on some additional analyses of the wage rates of the apprentices covered by the earlier New York study. Data from approximately 6,800 of the 9,500 usable questionnaires returned earlier were used for the analysis. Barocci reported that the sample of 6,800 was a valid representation of the entire population of New York apprentices over the 1958-69 period and concluded that completion of the apprenticeship program added only 31 cents per hour ($600 per year) to the average wage rate of former apprentices, possibly less than the opportunity cost of remaining in apprentice status for the full term of indenture. Thus, apprenticeship completion appears to be much less important than attainment of journeyman status and/or union membership, if maximization of hourly wages is the criterion. Another interesting observation of Barocci's analysis is that formal education beyond high school had no influence on post-apprenticeship earnings.

Two earlier studies conducted in Wisconsin (one of them by Barocci) compared completers and dropouts in the Wisconsin apprenticeship system.

G. Soundarra Rajan, in A Study of the Registered Apprenticeship Program in Wisconsin, 1966, was concerned with the fact that the number of dropouts from Wisconsin Apprenticeship programs between 1911 and 1963 was almost as high as the number of completers. In 1964, questionnaires were mailed to 1,419 apprentices who had dropped out of an apprenticeship program between 1958 and 1964. Twenty six percent returned the questionnaire. All of the respondents were male, the majority of them in their late twenties and early thirties. More than 70 percent were married, and 60 percent had two or more children. Almost all the respondents indicated the reasons why they had left the apprenticeship program. About 33 percent stated that they did so for reasons relating to their occupation or working conditions (working at jobs other than the indentured one, "dirty" work, boring work, no future, poor employer-employee relationship). Employer bankruptcy and lay off were cited by almost 25 percent, and about 16 percent gave low wages as the reason. Reasons for dropping out were examined in comparison with respondent's age, educational attainments, marital status, current occupation, current income, and family background. As age increased, there was increasing concern about low wages. Low wages were of much greater concern to married men, while working conditions and personal reasons were more important to single dropouts.

In a methodologically more rigorous study, The Drop-Out and the Wisconsin Apprenticeship Program: A Description and Econometric Analysis, 1972, Barocci found that those most likely to complete apprenticeship training were white, male, married with dependents, and union members. Barocci mailed questionnaires to 936 dropouts and 488 completers, a sample of some 3,500 dropouts and 7,000 completers of Wisconsin apprenticeship programs during the six-year period from the beginning of 1965 to the end of 1970 (immediately following the period studied by Rajan). A total of 246 dropouts and 230 completers returned the questionnaire. Some 50 variables were examined under the following categories: personal and occupational characteristics; preapprenticeship experience; apprentices' attitudes toward in-school and on-the-job training; apprentice wage rates and post-apprenticeship employment and income; and reasons for cancellation of indenture.

In addition to sex, race, marital status, and union membership, several other factors were also found to be significantly related to completion. The specific occupational area chosen had a significant influence upon probability of completion. A ranking of the occupational trades in order of influence on completion would put industrial trades first, construction second, service third, and graphic arts last. Those who have more education (over 12 years of former schooling) or have the desire to get more education are more likely to drop out than those who are less educated (under 12 years of formal schooling). Participants' rating of on-the-job training appeared to be important as well. In addition to program completion, duration of stay in a program was also examined. The same four major factors that influenced completion also influenced the percentage of a program that an apprentice can be expected to complete--namely marital status, sex, race, and union membership. Once again, the participant's rating of on-the-job training also appeared to be important.

The [illegible]rocci study provided the model for a subsequent study by Hansen and [illegible], Drop Outs and Completers in the Utah Apprenticeship System 1969-74: Some Causes and Consequences, 1975. They found that completers were older, married, and had more dependents than dropouts. Other interesting findings were: completers had received better pre-apprenticeship advice and information; attendance at a vocational school had no relationship to likelihood of completion; many apprentices dropped out because of normal attrition, although apprentice-employer problems were a prominent factor in many decisions; dropouts are currently employed in the trade in which they were apprenticed and earn substantial incomes approaching those of completers; and a substantial proportion of dropouts hold supervisory positions.

In reviewing the studies for particular relevance to the present research on Pennsylvania apprentices, it was found that one factor mentioned by the New York and Utah studies was that completers took more preapprenticeship job-related courses and had better preapprenticeship advice. The Barocci Wisconsin study found that, while apprentices knew quite a bit about the trade before beginning an apprenticeship, little of their information and no encouragement was received from high school guidance counselors and teachers. Barocci recommended that more literature, geared to students and faculty, be distributed in the high schools and vocational schools. Indeed, one of Barocci's major recommendations was for beginning apprenticeship training during high school years to facilitate the transition from school to work.

Another factor of possible relevance for this study was the influence of the chosen occupational trade on completion of apprenticeship. The Utah study, the New York Study, and the subsequent Barocci analysis of that study, indicate that substantial numbers of dropouts across trades continue to work in the trade in which they were apprenticed. While there is some disagreement over completion rate by trade (Glover argues that carpenters have the lowest completion rates--50 percent--while Barocci finds that construction trades include more completers than service or graphic trades), it is interesting that the Barocci Wisconsin study found that reasons for cancellation of indenture appeared to differ by trade. In the construction trade, apprentices dropped out primarily for personal reasons and other job opportunities. In service and industrial trades, the apprentices were not pleased with the treatment they received from employers and/or the pay rate. It is therefore obvious that the characteristics and attitudes of employers play some part in the decision to complete apprenticeship or drop out. Vocational educators preparing students for apprenticeship need to understand the nature of these employer characteristics and attitudes and communicate them to students as part of their preapprenticeship training.

To summarize the research findings on completers and dropouts, it appears that perhaps four major categories of factors may be interacting to result in the decision to complete or drop out of a program: (1) personal characteristics of apprentices; (2) the method of operation of the apprenticeship program in a particular trade in a given locale (for example, pay rates, on-the-job training, employer attitudes and characteristics); (3) the perception by the apprentice of whether or not he or she could drop out and still work at a journeyman level in the trade, obtain steady work, and earn good pay; and (4) the local labor market conditions. Better understanding of these relationships by vocational educators would help them to prepare students for the realities of apprenticeship in a particular trade. While the present study could not extensively explore complex relationships that many other studies have barely touched upon, an attempt was made to investigate some of these relationships, based on selected indicators, for Pennsylvania apprentices.

4. Vocational Education and Apprenticeship

Relatively little research has been done on the connections between vocational education and apprenticeship, despite the long histories of formal institutions in providing each. One of the reasons for this lack of information is that vocationalism and apprenticeship have legislative and political histories that have tended to make them alternative routes for attainment of skills in the crafts and trades. Detailed analyses of the history of vocationalism and apprenticeship can be found in Lazerson and Grubb, American Education and Vocationalism, 1974, and in Cassell and Associates, Inc., Illinois Apprenticeship Study, 1974.

Despite the history of antipathy and competition, apprenticeship sponsors will commonly agree to two ways in which vocational education and apprenticeship can work together. First, vocational education can help to channel well-prepared and well-informed candidates into apprenticeship. Second, public vocational education can serve as a resource for providing the related instruction portion of training in apprenticeship and instructor preparation. In his 1980 paper, Glover discusses both of these roles and indicates that it is entirely possible to form an alliance between vocational education and apprenticeship that would accomplish far more than either system can accomplish on its own. A lasting alliance needs to be based on knowledge, a respect for the integrity of each system, and a recognition of the comparative advantages of each form of training. It is Glover's belief that since both apprenticeship and vocational education are decentralized networks, working arrangements will have to be left to the local level, although national leadership can help to point the way and create a conducive environment.

Glover also discusses some present limitations on the role of vocational education in providing a source of apprentices and related instruction. These include the following:

- Not all apprenticeship programs are in need of additional applicants. Some programs do not indenture apprentices directly from school. Perhaps 20 to 30 percent of apprentices are selected from current employees.
- A major obstacle to placing vocational education graduates into apprenticeships is the view of some apprenticeship officials that vocational education is the traditional dumping ground for less motivated and less able students--not a very likely source of good candidates. VICA and other student organizations provide one approach to improving vocational education's image.
- The average age of entering apprentices appears to be about 23, five years after the average secondary school student has graduated (information on average age is sketchy). Although Glover does not discuss the future, it is possible that this situation will change as the baby boom passes and fewer young people are available for apprenticeship or other work. However, at the present time, this situation and the preference of employers for "mature" applicants exists.
- While advanced placement for post-training and work experience is provided in almost all apprenticeship programs, the evaluation of past work experience and knowledge is an inexact

science, and credit practices are not uniform across local work areas even within the same trade. The key in referring vocational education graduates to apprenticeship will be in preparing well-qualified applicants.

- In better financed apprenticeship programs, there is a trend toward having one's own training facilities. For less well financed programs, the trend seems to be toward providing community college facilities and accreditation for apprenticeship learning. In either case, there seems to be a trend away from conducting related training in secondary institutions based upon, among other things, a dissatisfaction with the treatment that programs receive in public vocational education facilities.

The Illinois study and the Glover paper both agree on the need for increased communication and cooperation. The Illinois study details specific steps for creating a regional apprenticeship advisory board to focus on linkages between vocational education, apprenticeship officials, and state agencies to improve preapprenticeship education, career guidance, apprenticeship training, and so forth, in the hope of ultimately producing an improved economic and educational environment. Glover suggests that state education agencies add a full-time member, who is familiar with apprenticeship programs and vocational education issues, as a liaison person to work on problems within the state and with other states.

Interestingly enough, a 1969 Study of the Training of Tool and Die Makers in Boston, by Horowitz and Herrnstadt, adds a note of optimism to the quest for cooperation and communication between vocational education and apprenticeship. This study was conducted to test a methodology to determine the combination of education, training, and experience most likely to yield highly qualified workers. The methodology was a questionnaire personally administered by an interviewer to apprentices, program sponsors, and union officials, employers, supervisors, and others. One of the key findings was that only apprentices with a background in vocational education scored high on measures of effectiveness such as supervisors' performance ratings, duration of training, and amount of training time needed to become a competent craftsman. In a field where research tends to deal mainly with descriptive information, it is interesting that one of the few studies employing effectiveness measures to rate qualified workers found that the combination of vocational education and apprenticeship was successful.

C. The Study Design

1. Apprenticeship Survey

Three different questionnaires using three methods of assessment were used in this study: mail, telephone, and personal interview. The primary measure on which this study was built is a 25-question Apprenticeship Survey, which was mailed to all apprentices in the sample (see Appendix A). It consists of questions regarding the apprentice's personal and educational background, trade-related experiences, and sources of information regarding apprenticeship. One section of the survey asks apprentices to rate themselves in certain trade-related areas and then to provide the ratings that they would expect from their employers. In another section, the apprentices are asked to rate the apprenticeship program and their experiences as participants.

A total of 980 Apprenticeship Surveys were mailed to first-year apprentices in various areas of Pennsylvania on June 10, 1981. Address information was available for a total of 934 active and 46 inactive apprentices across the three trade areas selected for study. Carpenters, Machinists, and Auto Mechanics were selected to be surveyed because they represent construction, manufacturing, and service trades* that have parallel secondary school vocational education programs, and they have the highest first-year enrollments. Geographically, the survey sample was representative of apprentices in these three trade areas throughout the state of Pennsylvania. Surveys were well distributed across the Erie, Pittsburgh, Harrisburg, Allentown, and Philadelphia areas.

Two weeks after the initial mailing, postcard reminders were sent to apprentices who had not yet returned their surveys to ETS. The number of responses received for each of the three trade areas as of November 2, 1981, is presented in Table II.1.

Note that only 15 surveys were returned that were completed by inactive apprentices. Because it is not possible to draw meaningful conclusions from such a small sample, the inactive group was omitted from all of the data analyses. However, the reader may be interested in a brief description of the respondents from the inactive sample. Their age range was between 19 and 36 years and only four were under 21 years old. Three of the fifteen inactive apprentices were female, and only one was a union member. They were about equally representative of different high school programs: four were from academic programs, six from vocational education, and five from general education. Nine of the inactive apprentices had less than one year of trade-related work experience prior to apprenticeship, and eleven had no relatives or friends working in the trade.

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*The three trade areas specified in the RFP

Half of the inactive group expressed negative opinions of the apprenticeship program in that they rated the pay and the attitude of employers as below average. It would be interesting to know whether their negative opinions are a cause or an effect of their lack of success.

Although the response rate for active apprentices ranged between 60-70% in each trade area, the small size of the Auto Mechanics sample should be kept in mind when interpreting the data herein. However, it is fairly safe to draw conclusions from this small sample because it does represent a sizeable percentage (60%) of the total population of first-year auto mechanics (N=71) in Pennsylvania.

2. Telephone Interview

The last question on the Apprenticeship Survey asked whether the apprentice would provide a home telephone number where he or she could be reached for a telephone interview. During the middle of December 1981, ETS staff called 63 (10%) of the apprentices who agreed to participate in a telephone interview. The number of successful contacts by trade area are shown in Table II.2.

The Telephone Interview had three purposes. It was conducted primarily so that specific issues of interest in this study could be investigated in more depth. Secondly, the Telephone Interview was used to verify some of the responses that had been received on the mail survey. The third purpose of the Telephone Interview was to secure the apprentice's permission to contact his or her employer for an interview.

The Telephone Interview consists of seven questions that deal with motivation for becoming an apprentice and the apprentice's evaluation of his or her high school experiences (see Appendix B). Because the final sample consisted of only 49 people, the data collected in this interview were not analyzed separately by trade. However, the Apprenticeship Survey data from the telephoned subsample (N=49) were compared with those of the total sample (N=628) in order to determine the representativeness of this smaller group. The breakdown of response percentages on every survey item indicated that the characteristics of the subsample reflected those of the larger group. Therefore, although the final telephone sample is only 8% of the total sample, we can be confident that this group forms a good representation of all of the apprentices in the initial mail survey.

The Telephone Interview, although brief, provided a great deal of qualitative information about the typical apprentice's background and opinions. The findings from this part of the study are discussed in Chapters III and VI of this report.

The Telephone Interview served as a verification check on Apprenticeship Survey responses in that the following question appeared in both surveys: "At the time you made application to the apprenticeship program, did you have relatives or friends in your apprentice program?" When the answers given by the 49 people in the telephoned sample were compared to their mail survey responses, only 14% were discrepant. Therefore, we can be fairly confident that the responses given in the Apprenticeship Survey were reliable measures.

3. Employer Survey

The final question posed in the Telephone Interview was, "May we contact your employer for follow-up information?" As Table II.2 shows, 30 of the apprentices gave permission for ETS staff to talk to their employers and 5 did not. For 14 of the apprentices, employer contact was not relevant because the apprentice had just recently begun a new position or was currently unemployed. The Apprenticeship Surveys of the eight people who said that they were unemployed were examined in order to determine whether the group was a select one in any way. However, it did not appear that this small group had any distinguishable characteristics. Therefore, it was concluded that the sample of apprentices for whom it was possible to conduct Employer Surveys were representative of the total group of apprentices studied.

The Employer Survey was conducted in person with 21 of the employers, and the surveys were mailed to the remainder. Eight of the mail surveys were returned completed, and the incomplete one had a note explaining that the apprentice no longer worked for the employer.

The Employer Survey is composed of two sets of ratings of particular apprentices and four questions about apprentices in general (see Appendix C). Those interviewed in person were also asked the nine open-ended questions on the Structured Employer Interview Form (see Appendix D). This form consists of questions that delve into the employer's experiences with apprentices and apprenticeship programs in more detail. Findings from the Employer Survey and Interview are discussed in Chapter V.

Table II.1

Response Rates for the Apprenticeship Mail Survey

ACTIVE APPRENTICES

Population	Total Sent	Usable Return	% Returned
Carpenters	487	320	66%
Machinists	376	265	70%
Auto Mechanics	71	43	60%
Total	934	628	67%

INACTIVE APPRENTICES

Population	Total Sent	Usable Return	% Returned
Carpenters	25	8	32%
Machinists	16	4	25%
Auto Mechanics	5	3	60%
Total	46	15	33%

Table II.2

Response Rates for the Apprenticeship Telephone Follow-up Interview

	STUDY POPULATION	TOTAL RESPONSES FROM MAIL SURVEY	SAMPLE SIZE 10% OF TOTAL	PERSONS CONTACTED		PERSONS NOT CONTACTED	REASONS FOR INCORRECT PHONE NO.	NO CONTACT NO ANSWER AT NUMBER GIVEN	PERMISSION TO VISIT EMPLOYER			
				#	%				YES	NO	EXPLANATION	
CARPENTERS	487	320	32	26	81	6	3	3	14	12	DENIED NEW EMP. UNEMPLOYED	3 3* 6**
MACHINISTS	376	265	27	21	78	6	3	3	15	6	DENIED NEW EMP. UNEMPLOYED	2 3 1
AUTO MECHANICS	71	43	4	2	50	2	2	0	1	1	DENIED NEW EMP. UNEMPLOYED	0 0 1
TOTALS	934	628	63	49	78	14	8	6	30	19	DENIED NEW EMP. UNEMPLOYED	5 6 8

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*The respondent had moved to a new position. The rating of employer/employee would not now be relevant.
**The respondent was unemployed at the time of follow-up.

III. Entrance into Apprenticeship

A. Personal Characteristics

A total of 628 first-year apprentices completed and mailed back the Apprenticeship Survey--320 Carpenters, 265 Machinists, and 43 Auto Mechanics. Their key personal characteristics are summarized in Table III.1 for each of the three trade areas. When the differences in characteristics among trade areas are so large that they are statistically significant (at the .05 or .01 level), the corresponding chi-square statistic is reported. The bar graphs (Figure III.1) provide a graphic description of the apprentices' personal characteristics.

It is evident from the table and graphs that the Carpenter, Machinist, and Auto Mechanic apprentices were nearly all (about 90%) white males.* Small percentages of Black, Hispanic, and other racial groups were apprenticing in all trades except auto mechanics, which had no Black or Hispanic respondents.

Apprentices ranged in age from 18 to 49; their average age was 24 years. The mean age varied somewhat between trades: Carpenters $\overline{X} = 23$ years, Machinists $\overline{X} = 24$ years, Auto Mechanics $\overline{X} = 26$ years. Some 87% of the apprentices were 29 or younger. The Carpenters had the lowest percentage of apprentices older than 29, and Auto Mechanics had the highest percentage of older apprentices. In a recent study, Glover (1980) also found the average age of entering apprentices to be about 23--five years past high school graduation age. As Glover suggests, this finding indicates a preference among employers for "mature" applicants.

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*Because the sample was nearly all male, the pronoun he is used throughout the remainder of this report for the sake of brevity.

Across the three trades, an average of 12% of the apprentices were veterans; however, this figure was much higher (37%) for Auto Mechanics. There were only eight handicapped apprentices (1%) in the entire sample.

At the time that they applied to the apprenticeship program, 26% of the respondents were married. By the time they completed the Apprenticeship Survey, the number of married apprentices rose to nearly one third (32%). From Table III.1, it is evident that along with being older and having a larger percentage of veterans, the Auto Mechanics trade had a considerably higher percentage of divorced/separated apprentices. Upon application to the apprenticeship program, two thirds (66%) of the apprentices had no dependents (not counting themselves), and most of those who did had only one. A larger percentage of apprentices claimed to have one or two dependents by the time they were into their first year of apprenticeship. The fact that only small percentages of apprentices were married or veterans lends little credence to previous research that says that married men and veterans are favored in the admission into apprenticeship because they are perceived to have greater stability in work habits (Glover, 1980). If it had been possible to collect enough data on apprenticeship program dropouts, another previous research finding could have been tested--the premise that program completers are older, married, and have more dependents than dropouts (Hansen, 1975).

In addition to marital status and number of dependents, union status was another characteristic that changed after acceptance into apprenticeship. Although change in family status may be at least partially explained by the passage of time, the increase in union membership was probably related to joining the apprenticeship program. Across all trades, the percentage of respondents who claimed union membership tripled from the time of apprenticeship application (16%) to the time that they were surveyed as active apprentices (48%). This trend toward union membership varied considerably by trade; it was most evident for Carpenters, somewhat evident for Machinists, and not present at all for Auto Mechanics. Since most of the apprentices were not union members at the time they applied, union membership did not appear to be a prerequisite for acceptance into most programs. However, over half (56%) of the apprentices said that when they applied to the program they were employees of the companies where they were apprenticed at the time of the study. It is therefore likely that many employers selected program applicants from a "restricted pool" of their own employees. This finding supports previous research that suggests that one third to one half of all apprenticeship programs select applicants from a restricted pool of existing employees, particularly manufacturing programs (Glover, 1980). However, it should be noted that percentages also varied by trade; the majority of Carpenters were not company employees prior to apprenticeship.

Table III.1

Personal Characteristics of PA Apprentices (In Percentages*)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43	
Sex:					
Male	93	94	93	95	
Female	5	5	5	5	
Race:					
White	90	89	91	93	
Black	4	7	2	0	
American Indian/ Alaskan	2	1	3	2	
Hispanic	(.5)	(.3)	(.8)	0	
Asian/Pacific Islander	(.5)	0	(.8)	2	
Age:					
18-21	44	40	52	23	
22-29	43	52	31	54	
30-39	10	7	13	19	
40-49	2	2	4	5	
	(Mean = 24)	(Mean = 23)	(Mean = 24)	(Mean = 26)	
Veteran:					
Yes	12	11	11	37	$X^2 = 25.41$
No	86	88	87	63	$(p<.01)$
Physically Handicapped:					
Yes	1	--	--	--	
No	99	--	--	--	
Marital Status at Time of Application:					
Single	67	72	63	51	$X^2 = 34.82$
Married	26	23	29	28	$(p<.01)$
Divorced/Separated	3	2	2	16	
Widowed	0	0	0	0	
Marital Status at Time of Interview:					
Single	58	57	62	47	$X^2 = 22.58$
Married	32	34	29	30	$(p<.01)$
Divorced/Separated	4	2	4	16	
Widowed	0	0	0	0	

Personal Characteristics of PA Apprentices (continued)
(In Percentages*)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43	
No. Dependents at Time of Application:					
0	66	68	65	56	
1	17	20	14	12	
2	9	8	10	12	
3	4	3	5	6	
4	3	1	4	12	
Greater than 4	1	1	2	1	
No. Dependents at Time of Interview:					
0	59	60	61	43	
1	18	21	14	17	
2	13	11	13	20	
3	7	6	6	9	
4	3	1	3	9	
Greater than 4	1	1	2	0	
Union Membership at Time of Application:					
Yes	16	13	21	5	$X^2 = 11.04$
No	82	85	77	93	$(p<.01)$
Union Membership at Time of Interview:					
Yes	48	69	29	5	$X^2 = 122.23$
No	50	30	67	93	$(p<.01)$
Employee of Company at Time of Application:					
Yes	56	37	79	63	$X^2 = 114.05$
No	41	62	18	37	$(p<.01)$

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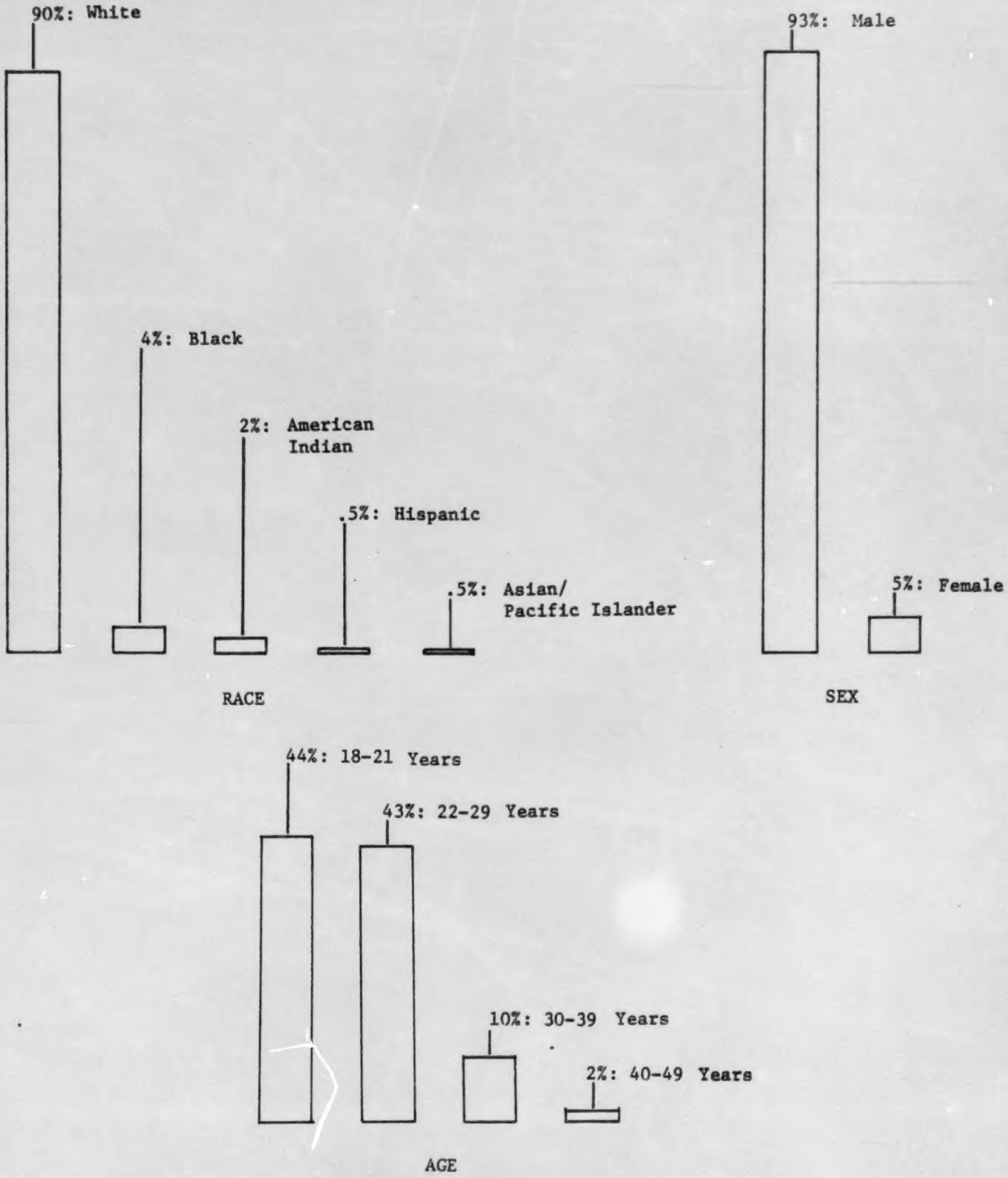
*Missing data may account for any difference between 100% and the numbers shown.

Figure III.1

Personal Characteristics of PA Apprentices (In Percentages*)



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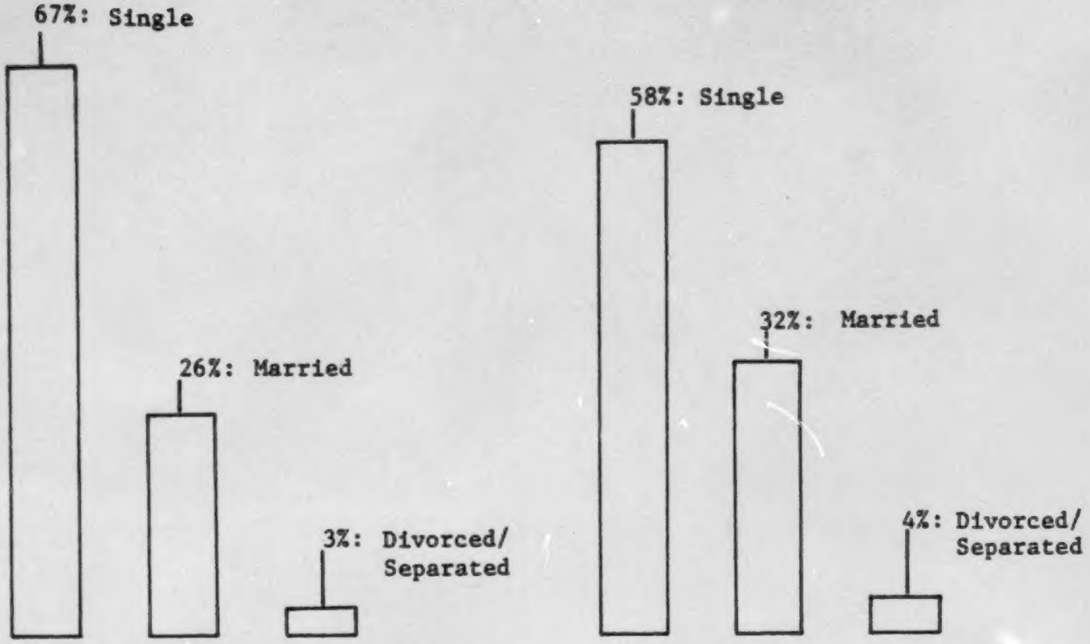
*Missing data may account for any difference between 100% and the numbers shown.

Figure III.1 (Continued)



MARITAL STATUS AT TIME OF APPLICATION

MARITAL STATUS AT TIME OF INTERVIEW

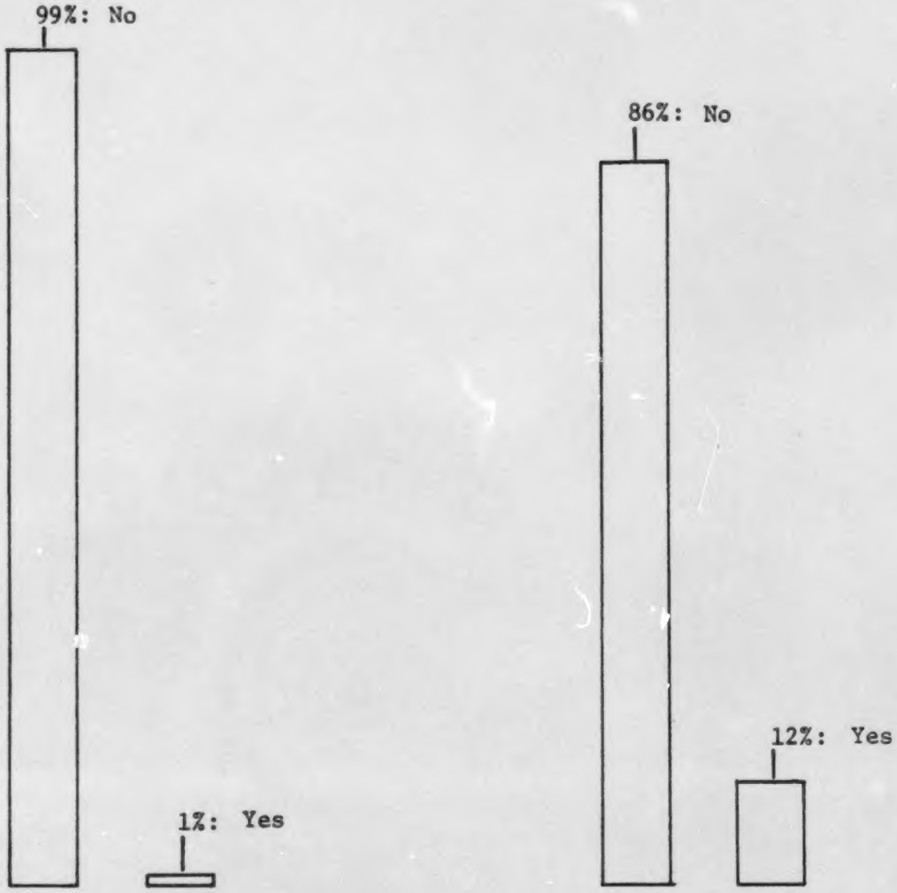


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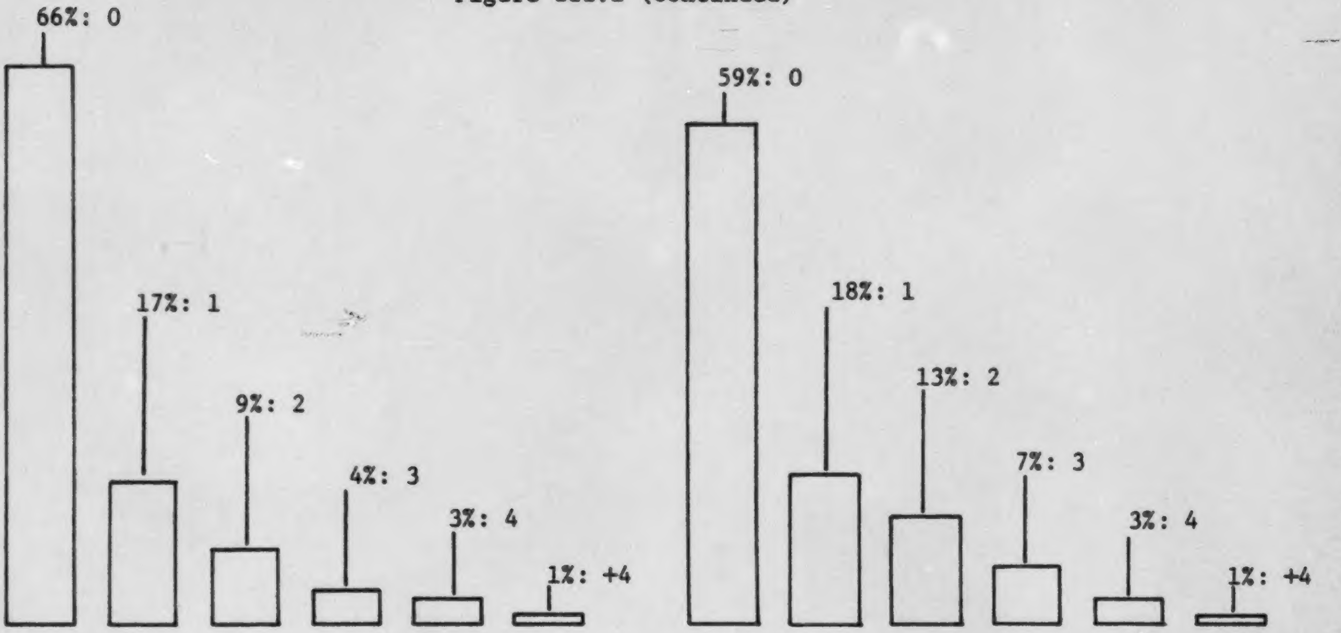
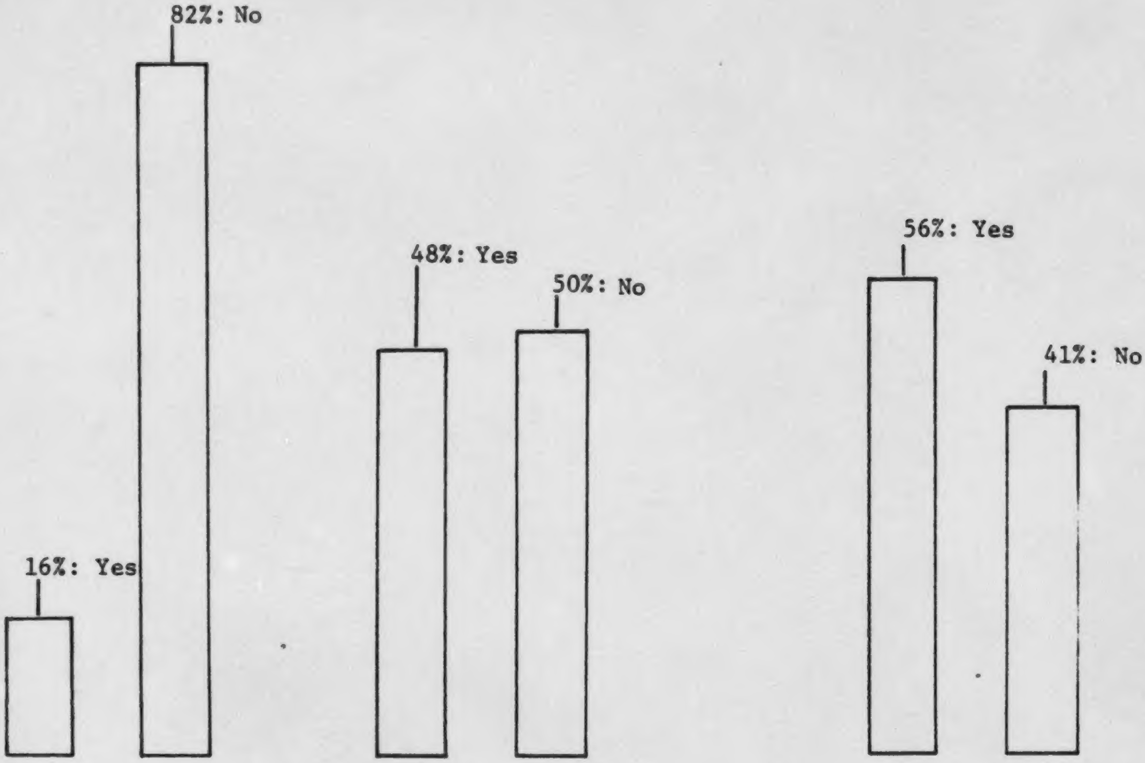
Figure III.1 (Continued)



NUMBER OF DEPENDENTS AT TIME OF APPLICATION

NUMBER OF DEPENDENTS AT TIME OF INTERVIEW



UNION MEMBERSHIP:

AT TIME OF APPLICATION

AT TIME OF INTERVIEW

EMPLOYEE OF COMPANY
AT TIME OF APPLICATION

B. Educational Background

Altogether, apprentices were about evenly divided in terms of which program they were enrolled in while attending high school: 30% academic/college preparatory, 41% vocational or business education, and 27% general education (see Figure III.2). However, quite a bit of variance from these percentages was evident when the trades were examined separately (see Table III.2). The majority (53%) of Machinists were from vocational education programs. This percentage was quite high considering that only about one third of the Carpenters and Auto Mechanics had vocational education backgrounds. These latter percentages were more in line with those found by Swanson (1973), who reported that only 25% of new apprentices are from vocational education programs.

Of the three trades, Carpenters had the highest percentage of apprentices from academic backgrounds, and Auto Mechanics had the highest percentage from general education programs.

Apprentices were asked for the highest level of education they completed (see Figure III.2). Of those who responded, all but 3% said that they had gone at least as far as receiving a high school diploma or the equivalent. Of the apprentices who studied beyond high school, 27% took courses at business or trade school, community college or college. An additional 11% received either a trade/skill certificate or a two-year degree. However, only 3% went as far as earning a four-year college degree. When the educational level of apprentices in the three trades were compared, differences were found to be slight with a few exceptions. The Auto Mechanics trade had a much higher percentage (12%) of apprentices without high school diplomas.

About one quarter of the Carpenters had attended some college, as might be expected from the large percentage with academic backgrounds. Similarly, about one quarter of the Machinists had attended business or trade school; this was a likely route for apprentices in this field, given that so many of them were from vocational or business education programs.

Apprentices described their average grades in high school English and math and grades earned in apprenticeship courses. The majority of apprentices in all three trades reported B or B-C grades in English, and A-B or B grades in math. For apprenticeship courses, most of the respondents said that they earned A or A-B grades, with a smaller percentage giving B as their average grade. Apprentices across the three trade areas did not show a substantial amount of variance with respect to their reported grades.

In addition to describing their educational programs and grades, apprentices were asked to rate their ability in reading and math. Overall, apprentices rated their reading ability lower than their math ability. The largest percentage (50%) of apprentices said that they had average reading ability, and most (39%) of the remainder rated themselves as above average or excellent in reading. However, the apprentices rated their math ability even higher; 53% said that they were above average or excellent in math. Fewer (41%) of the respondents rated their math ability as average.

Table III.2

Educational Background of PA Apprentices (In Percentages*)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43	
High School Program:					
Academic/College Prep.	30	37	24	24	
Vocational or Business Education	41	33	53	37	
General Education	27	30	23	39	
Highest Level of Education:					
Less than 4 Years H.S.	3	2	3	12	$X^2 = 25.69$
H.S. Graduate	51	49	54	49	$(p<.01)$
Some Business or Trade School	11	10	12	7	
Some College	16	19	12	16	
Trade Cert. or 2-Year Degree	11	9	13	12	
4 Year College Degree or Beyond	3	5	2	2	
H.S. English Average Grade:					
A	6	7	5	5	
A-B	15	15	15	14	
B	25	26	23	26	
B-C	25	25	26	28	
C	19	20	20	12	
C-D	6	4	7	12	
D	1	1	2	2	
Below D	1	1	(.4)	2	
H.S. Math Average Grade:					
A	14	17	12	14	
A-B	27	27	25	30	
B	25	24	26	23	
B-C	18	17	19	14	
C	10	10	10	12	
C-D	4	4	3	2	
D	1	1	1	5	
Below D	0	0	0	0	

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*Missing data may account for any difference between 100% and the numbers shown.

Educational Background of PA Apprentices (continued)
(In Percentages*)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43	
Apprenticeship Class Average Grade:					
A	26	24	28	26	
A-B	30	32	29	21	
B	21	20	22	19	
B-C	8	10	7	7	
C	3	3	3	5	
C-D	1	2	1	0	
D	0	0	0	0	
Below D	0	0	0	0	
Reading Ability - Self-Rating:					
Excellent	11	11	10	23	$X^2 = 15.52$
Above Average	28	26	32	23	($p<.05$)
Average	50	51	50	40	
Fair	8	9	5	14	
Poor	1	2	1	0	
Math Ability - Self-Rating:					
Excellent	14	16	11	16	$X^2 = 22.65$
Above Average	39	39	42	23	($p<.01$)
Average	41	41	40	44	
Fair	4	3	4	16	
Poor	(.5)	1	(.4)	0	

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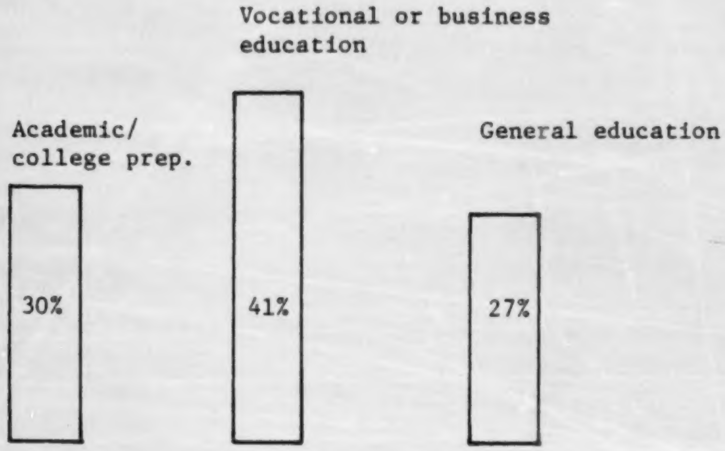
*Missing data may account for any difference between 100% and the numbers shown.

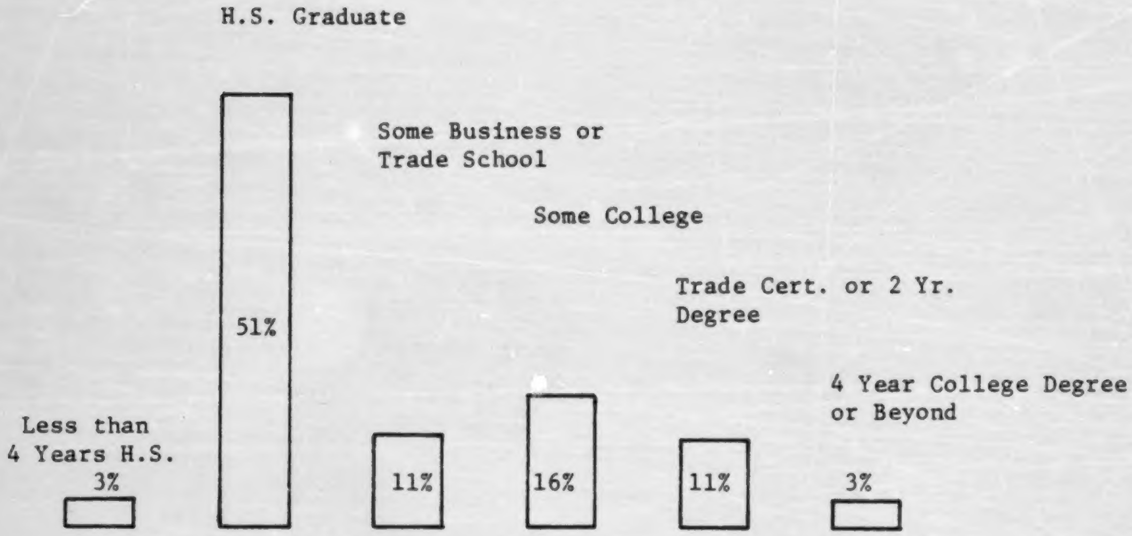
Figure III.2

Educational Background of PA Apprentices
(In Percentages*)

HIGH SCHOOL PROGRAM:



HIGHEST LEVEL OF EDUCATION:



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*Missing data may account for any difference between 100% and the numbers shown.

C. Parent Profile

In order to further refine our portrait of first-year apprentices, some information about their parents was collected. Parents' level of education or occupation could be related to their child's decision to enter apprenticeship. One or both of these variables may also influence the degree of satisfaction that their child experiences from working in a trade area. Therefore, apprentices were asked not only about their own educational background but also about their parents' or guardians'. In the Apprenticeship Survey, respondents marked the highest level of education completed by their mother and their father. They also selected the kind of work that each of their parents does from a list of 13 occupations. Their responses are broken out by trade area in Table III.3.

All but about one third (29%) of the apprentices' fathers had graduated from high school but only 27% of them had gone beyond that to business school, trade school, or college. Only 7% of the fathers had earned a trade/skill certificate or a two-year degree. Very few (9%) had four-year college degrees.

Apprentices' mothers were more inclined to have high school diplomas; only about a quarter (22%) of them did not. However, even fewer mothers (16%) than fathers had attended a training program or took courses after high school. A mere 3% of the mothers had four-year college degrees.

When the apprentices' education was compared to that of their parents', it was evident that the younger generation had had a greater amount of formal educational training (see Tables III.2 and III.3). Nearly half (41%) of the apprentices had studied at a business school, trade school, or college after graduating from high school.

After reporting their parents' educational level, apprentices classified each of their parents' occupations as one of the following:

Clerical such as bank teller, bookkeeper, secretary, typist, mail carrier, ticket agent

Craftsman such as baker, automobile mechanic, machinist, painter, plumber, telephone installer, carpenter, iron worker, cement mason, electrician, welder

Farmer, Farm Manager

Homemaker or Housewife

Laborer such as construction worker, car washer, sanitary worker, farm laborer, janitor, private household worker

Manager, administrator such as sales manager, office manager, school administrator, buyer, restaurant manager, government official

Operator such as assembler, machine operator; taxicab, bus, or truck driver

Professional such as accountant, artist, clergy, dentist, physician, registered nurse, engineer, lawyer, librarian, teacher, writer, scientist, social worker, actor, actress

Proprietor or owner such as owner of a small business, contractor, restaurant owner

Protective service such as detective, police officer or guard, sheriff, fire fighter

Sales such as sales person, sales clerk, advertising or insurance agent, real estate broker

Service such as barber, beautician, practical nurse, waiter

Technical such as draftsperson, medical or dental technician, computer programmer

Table III.3 shows the outcome of these classifications. Not surprisingly, most (37%) of the apprentices' fathers were craftsmen as well. This percentage varied only slightly across trade areas. For the Carpenters and Machinist apprentices, the next common occupations for fathers were machine or vehicle operators (12%) or manager/administrators (10%). Auto Mechanics had fewer fathers in these two occupational categories and more in laborer trades.

TABLE III.3
Profile of the Parents of PA Apprentices
(In Percentages*)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43	
Father's Highest Level of Education:					
Less than 4 Years H.S.	29	26	32	30	
H.S. Graduate	38	43	35	28	
Some Business or Trade School	6	4	6	9	
Some College	5	5	5	7	
Trade Cert. or 2 Yr. Degree	7	6	8	2	
4 Year College or Beyond	9	11	6	9	
Mother's Highest Level of Education:					
Less than 4 Years H.S.	22	19	23	40	$X^2 = 19.54$
H.S. Graduate	57	62	56	33	$(p<.05)$
Some Business or Trade School	6	5	7	2	
Some College	4	3	4	2	
Trade Cert. or 2 Yr. Degree	3	3	2	2	
4 Year College or Beyond	3	4	2	5	
Father's Occupation:					
Clerical	2	1	3	5	
Craftsman	37	40	35	35	
Farmer	1	1	2	2	
Homemaker	0	0	0	0	
Laborer	6	5	6	12	
Manager	10	12	9	5	
Operator	12	9	16	5	
Professional	7	7	7	7	
Proprietory	5	6	4	7	
Protective Services	1	1	1	0	
Sales	3	4	2	5	
Services	(.5)	(.3)	(.4)	2	
Technical	3	2	3	0	
Mother's Occupation:					
Clerical	18	18	18	9	
Craftsman	2	1	3	0	
Farmer	2	2	2	7	
Homemaker	38	38	36	49	
Laborer	4	3	6	5	
Manager	3	4	2	7	
Operator	4	3	7	0	
Professional	6	6	6	7	
Proprietory	2	3	1	0	
Protective Services	(.2)	(.3)	0	0	
Sales	4	5	4	2	
Services	6	5	6	2	
Technical	1	1	1	0	

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*Missing data may account for any difference between 100% and the numbers shown.

Most apprentices' mothers were homemakers (38%) or had clerical jobs (18%). Once again, these percentages were a bit different for Auto Mechanics, who had fewer working mothers.

D. Occupational Training, Trade-Related Activities, and Work Experience

In this section, the amount of overall exposure to trade areas prior to apprenticeship will be examined. In order to include all possible avenues of exposure to a trade, apprentices were asked not only about specific occupational training in their backgrounds but also about hobbies, club memberships, and work experience related to their trade.

1. Occupational Training

First, apprentices were asked whether they had received *any* occupational training prior to the apprenticeship program and if so, where this training took place. All of the sources of training listed in the questionnaire were marked by at least one apprentice. However, many apprentices marked "No Training." Figure III.3 provides a graphic description of their response breakdown. Across the three trade areas, over one third (36%) of the apprentices stated that they had not received any occupational training before apprenticeship.

It is evident from Table III.4 that Machinists gave fewer negative responses to this question, probably because, as mentioned in the section on educational background, the Machinist apprentices were more likely to have vocational education backgrounds from high school. The Auto Mechanics were less likely to mention high school as the source of occupational training and more likely to credit CETA and the military for their education. Only a small group of apprentices mentioned other types of educational institutions as places where they received occupational training (for example, community/ junior colleges). However, in all three trade areas, a sizeable percentage of apprentices noted "other" sources of occupational training such as skills centers, private job placement agencies, and on-the-job training.

2. Trade-Related Activities

For craftsmen, a great deal of learning takes place outside the classroom or work place in trade-related hobbies. Over one third of the apprentices surveyed said that they devoted two or more hours per week to such hobbies while in high school. Across trade areas, the average amount of time spent in trade-related hobbies while in high school was about four hours per week. It is evident from Table III.4 that it was Auto Mechanics who were most inclined (58%) to spend two or more hours per week on hobbies, and Machinists (23%) were the least inclined to spend this much time.

After high school, even more time was spent in trade-related hobbies--an average of 7-1/2 hours per week. When the time breakdowns by trade were examined it was found that Carpenters had the largest percentage (57%) of apprentices devoting at least two hours per week to trade-related hobbies, and this percentage was still the smallest for Machinists.

Along with hobbies, both in-school and out-of-school experiences in trade-related clubs were also investigated. Only 11% of the apprentices noted any involvement in high school clubs, with little variation by trade area. In addition, only 9% of the apprentices had ever been members of non-school clubs. It can be concluded that regardless of whether they are Carpenters, Machinists, or Auto Mechanics, only a few apprentices have held membership in any type of club related to their trade.

3. Work Experience

Because many on-the-job behaviors and attitudes develop from general work experience, it is important to look at this background characteristic as well as trade-related training and work experience. While in high school, all but

14% of the apprentices had at least some work experience. The largest percentage of apprentices (28%) had spent three or more years working during high school.

When questioned about general work experience after high school graduation, over half (54%) of the apprentices reported that they had spent three or more years working. This percentage was even greater for auto mechanics, 77% of whom had worked for at least three years since high school; however, this is not surprising considering that the Auto Mechanics were an older group of apprentices.

The next question on the Apprenticeship Survey focused on trade-related work--jobs that called for the same or similar skills and knowledge that they needed for their apprenticeship trade. About one quarter (26%) of the apprentices said that they had no prior work experience that was relevant to their apprenticeship. This total lack of on-the-job experience was a bit higher (31%) for Machinists, who tended to be a younger group. Although many apprentices were new to their trade, it can be seen in Table III.4 that an equally large group of apprentices (28%) had had three or more years of experience working in their field. Once again, probably because of age differences, this percentage was larger (44%) for Auto Mechanics, and smaller (19%) for Machinists who tended to be younger as a group.

TABLE III.4

Occupational Training, Trade-Related Activities, and Work Experience of PA Apprentices (In Percentages*)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43
Occupational Training Prior to Apprenticeship**				
YES	57	53	62	53[1]
H.S. Vocational Education	34	30	42	19[2]
CETA	5	5	4	16[3]
Military	5	4	5	19[4]
Business School or Technical Institute	5	6	4	7
Community/Junior Colleges	5	4	5	2
Four-Year Institution	2	2	2	2
Pre-Apprenticeship Training	6	6	6	2
Other	18	19	16	19
NO	36	41	29	40
Trade Related Hobbies--Hours Spent in High School				
0-1	64	56	77	42
2-9	16	21	11	12
10-19	12	13	8	29
20-29	6	7	4	15
30-39	1	1	(.4)	2
40-49	1	1	0	0
50-59	(.4)	1	0	0
	(Mean = 4.13)	(Mean = 5.10)	(Mean = 2.43)	(Mean = 7.66)
Trade-Related Hobbies--Hours Spent after Graduation				
0-1	55	42	71	47
2-9	19	24	14	13
10-19	12	15	7	13
20-29	6	8	2	8
30-39	2	3	2	3
40-49	5	6	3	11
50-59	1	1	1	0
	(Mean = 7.26)	(Mean = 9.02)	(Mean = 4.49)	(Mean = 12.26)

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*Missing data may account for any difference between 100% and the numbers shown.
**Each apprentice marked as many as applied, so percentages do not total to 100%.

[1] X^2 = 7.30 ($p<.05$)

[2] X^2 = 13.47 ($p<.01$)

[3] X^2 = 12.19 ($p<.01$)

[4] X^2 = 16.59 ($p<.01$)

Occupational Training, Trade-Related Activities, and Work Experience of PA Apprentices (In Percentages*) (continued)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43	
Trade-Related Clubs--Membership in High School					
NONE	82	80	85	77	
Less than 1 Year	3	4	2	2	
1 - 2 Years	2	2	2	2	
2 - 3 Years	3	4	2	0	
3 or More Years	3	3	2	2	
Trade Related Clubs--Membership Outside High School					
NONE	81	80	83	77	
Less than 1 Year	3	5	2	2	
1 - 2 Years	2	3	1	0	
2 - 3 Years	2	2	2	2	
3 or More Years	2	2	3	5	
Work Experience (Any Kind) During High School					
NONE	14	15	12	14	
Less than 1 Year	14	11	17	12	
1 - 2 Years	17	18	17	21	
2 - 3 Years	20	17	25	19	
3 or More Years	28	35	21	28	
Work Experience (Any Kind) After Graduation					
NONE	5	4	5	7	$X^2 = 26.19$
Less than 1 Year	8	9	7	7	$(p<.01)$
1 - 2 Years	14	13	17	7	
2 - 3 Years	16	14	22	0	
3 or More Years	54	58	46	77	
Trade-Related Work Experience					
NONE	26	22	31	23	$X^2 = 22.08$
Less than 1 Year	14	15	14	7	$(p<.01)$
1 - 2 Years	17	15	19	14	
2 - 3 Years	14	15	14	12	
3 or More Years	28	33	19	44	

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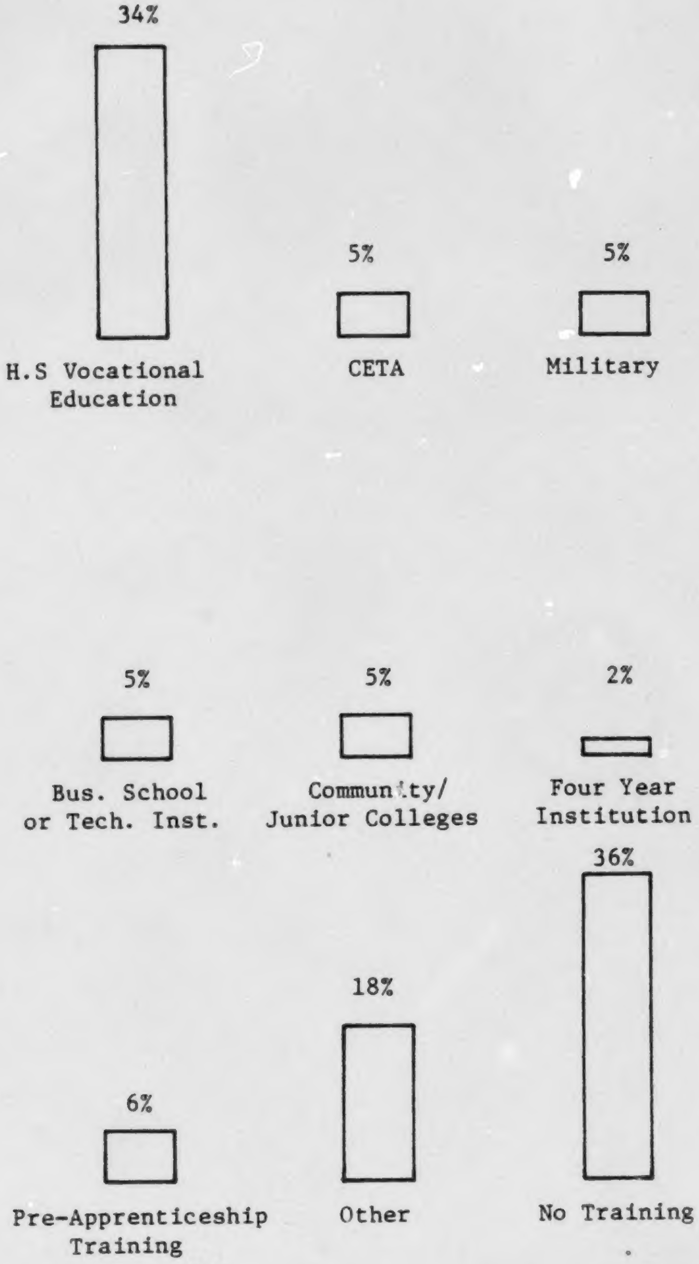
*Missing data may account for any difference between 100% and the numbers shown.

Figure III.3

Occupational Training Prior to Apprenticeship
(In Percentages*)



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*Missing data may account for any difference between 100% and the numbers shown. Each apprentice marked as many as applied so percentages do not total to 100%.

E. Sources and Accuracy of Information about Apprenticeship

1. Information Sources

In addition to actual courses taken in various trade areas, it is interesting to look at all of the individual sources from which apprentices get useful information about trades and apprenticeship programs. It may be that apprentices receive a lot of trade information from relatives and friends who are working in the same field. In the mail survey, apprentices were asked whether they had any relatives or friends in the trade at the time they applied for apprenticeship (see Table III.5). Only 14% of the Auto Mechanics answered "yes" to this question, but the percentages were higher for Carpenters (28%) and Machinists (27%). Most apprentices who answered "yes" had friends rather than parents or other relatives in the same apprenticeship program. Classmates in vocational education or training programs were probably considered as part of this group of friends.

This question was later posed to the 49 apprentices in the Telephone Interview (10% of the mail sample), and these results were confirmed. That is, about one-third (29%) of the apprentices answered that they did have relatives or friends in the same trade. In addition, most of them specified that they had friends (21%) rather than parents or other relatives (8%) in the trade.

Next, apprentices were asked who gave them useful information about trades and/or the apprentice program while they were in high school. Although few apprentices had parents who were in their trade, 28% of them said that their parents were a major source of information. In addition to parents, other relatives and friends were also noted as information providers by nearly a quarter of the sample (22%). These percentages are not very different from those of Swanson (1973), who reported that over half of the apprentices he sampled had learned about apprenticeship from parents, relatives, or friends.

School personnel who were most likely to provide information were vocational education teachers; they were credited by 21% of the Carpenters and 19% of the Auto Mechanics. It is not surprising that vocational teachers were valued by a substantially higher percentage (33%) of Machinists considering the fact that a greater number of Machinists had been vocational education students. High school counselors were also useful information sources for the Machinists (20%), Carpenters (16%), and Auto Mechanics (9%). Other (non-vocational education) teachers were mentioned by only 7% of the apprentices. Union literature (notices, brochures) and representatives from the union were noted as information sources only by the Carpenters, a great percentage of whom join unions as apprentices. However, non-union related literature and representatives from various companies were noted by small percentages of Machinists and Auto Mechanics.

Even though the research occurs ten years later, these results confirm those of the Barocci Wisconsin study (1972). That is, although school personnel provided information to some of the apprentices, the majority felt that little of their information about trades was received from high school guidance counselors and teachers. Barocci's recommendations for the high schools and vocational schools included distributing more apprenticeship literature to students and faculty and beginning apprenticeship training during the school years.

In addition to sources of information during high school, apprentices were asked who provided them with information after graduation. Once again, parents were mentioned as a major source of information by nearly one third of the apprentices (31%). Other relatives and friends became an even greater information source after high school; they were mentioned by nearly twice as many apprentices (41%). Literature and representatives from unions and industry also became more common information sources for most apprentices at this time. Although Auto Mechanics did not cite union information, a particularly large number of them (33%) mentioned state or federal apprenticeship agencies as disseminators of useful information.

Although apprentices were asked to indicate all of the information sources that they found useful, the average apprentice chose only one source out of the nine listed. In summary, the most popular sources of trade information during high school were parents and vocational education teachers. In the years after high school, although parents were still valued information providers, other relatives and friends were consulted even more frequently.

Table III.5

Sources of Information about Apprenticeship
(In Percentages)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43
Relatives and Friends in Apprenticeship				
YES	26	28	27	14
Parent	4	5	2	2
Other Relative	7	11	3	2**
Friend	23	22	25	14
NO	70	68	69	86
Sources of Information about Trades/Apprenticeships During High School				
Parent/Guardian	28	30	25	23
Other Relative or Friend	22	21	23	23
Counselor	17	16	20	9
Union Literature, Representative	3	5	(.4)	0**
Company Literature, Representative	4	2	5	5
Vocational Education Teacher	26	21	33	19**
Other Teachers	7	6	8	5
State/Federal Apprenticeship Agencies	2	3	0	2*
Community-Based Organizations	1	1	(.4)	2
None of the Above	26	28	25	26
Sources of Information about Trades/Apprenticeships after High School				
Parent/Guardian	31	35	27	28
Other Relative or Friend	41	45	37	30*
Counselor	3	2	3	12**
Union Literature, Representative	9	14	5	0**
Company Literature, Representative	20	11	31	14**
Vocational Education Teacher	7	4	10	7
Other Teachers	3	3	2	9
State/Federal Apprenticeship Agencies	7	4	6	33**
Community-Based Organizations	2	3	1	2
None of the Above	12	12	13	16

Note: Missing data may account for any difference between 100% and the numbers shown.

* Chi square was significant (p<.05).
** Chi square was significant (p<.01).

2. Information Accuracy

Apprentices were next asked how much accurate information they were able to get about their trade before they started the apprenticeship. They were asked to indicate the amount learned about each of the eight job characteristics listed in Table III.6.

For all trades combined, all but 9% of the apprentices said that they had at least "some accurate information about the general nature of the work" involved before starting apprenticeship. Over three quarters of the apprentices said that they had either "some" or "a great deal" of knowledge about working conditions, rate of pay, job opportunities, and steadiness of work in the trade.

When the three trades are examined separately, there are some interesting differences. Only 68% of the Auto Mechanics knew something about the rate of pay in their trade, compared to 80% of the Carpenters and 79% of the Machinists, many of whom claimed to have "a great deal" of knowledge about pay rates. The Machinists were particularly knowledgeable about job opportunities and steadiness of work. Nearly half of them claimed to have had "a great deal of accurate information." In contrast, Carpenters know "very little" about steadiness of work, perhaps because work schedules do fluctuate more in this trade.

Across the three trade areas, apprentices knew less about opportunities for promotion, apprenticeship duties and responsibilities, and working conditions than they did about other job characteristics. A particularly large number (33%) of them said that they knew very little about promotion, possibly because job openings and advancement opportunities vary by company and are difficult to predict.

Table III.6

Amount of Accurate Information Obtained about Trade Prior to Apprenticeship (In Percentages*)

	TOTAL N = 628	Carpenters N = 320	Machinists N = 265	Auto Mechanics N = 43	
Nature of Work					
A Great Deal	46	44	48	44	
Some	42	46	38	42	
Very Little	9	6	11	9	
Working Conditions					
A Great Deal	36	37	35	33	
Some	45	44	45	47	
Very Little	17	16	17	16	
Rate of Pay					
A Great Deal	41	46	39	26	
Some	37	34	40	42	
Very Little	18	18	17	30	
Job Opportunities					
A Great Deal	35	30	41	26	$X^2 = 10.37$
Some	43	45	40	47	$(p<.05)$
Very Little	18	20	14	23	
Steadiness of Work					
A Great Deal	39	33	47	30	$X^2 = 18.09$
Some	39	40	35	51	$(p<.01)$
Very Little	18	23	14	16	
Opportunities for Promotion					
A Great Deal	26	28	25	16	
Some	37	36	38	37	
Very Little	33	33	32	42	
Apprenticeship Duties and Responsibilities					
A Great Deal	31	30	31	28	
Some	40	41	40	35	
Very Little	25	26	23	30	
Apprenticeship Working Conditions					
A Great Deal	25	25	26	19	
Some	43	45	41	42	
Very Little	27	27	27	33	

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*Missing data may account for any difference between 100% and the numbers shown.

F. Motivation for Applying to the Apprenticeship Program

The direct incentives that lead people into the trades is an area that was explored only in the Telephone Interview. Therefore, data regarding decisions to enter apprenticeship are available for only 49 of the 628 apprentices in the total sample: 26 Carpenters, 21 Machinists, and 2 Auto Mechanics. Because this subsample group is small, only the results for the three trades combined are displayed in Table III.7.

The first question in the Telephone Interview was, "What were you doing at the time you applied to the apprentice program?" Over two thirds (69%) of the sample said that they were already working and most of the rest (16%) were going to school. Only three people were unemployed, and two were enrolled in CETA programs. It might therefore be concluded that since most people already have jobs when they go into apprenticeship, unemployment is not a primary motivator for joining the program.

The second question in the Telephone Interview directly asks, "Why was the apprenticeship program appealing to you?" The majority of the interviewees said that they were attracted to the opportunity for training and the job opportunities available through apprenticeship. Ten of the forty-nine apprentices mentioned pay as the reason for their attraction to apprenticeship. Others mentioned that they "liked apprenticeship work better," "enjoyed vo-tech classes," and "liked trade school." One apprentice noted "personal satisfaction" as the reason for applying to the program.

In order to see how much influence other people had on the apprentices' decisions, they were asked, "As you think back to high school, were you encouraged to go into the trades?" Twenty-four (49%) of the apprentices said that they had received encouragement. Parents were the primary source of encouragement during the high school years, which concurs with the mail survey finding that parents were a major source of information about apprenticeships at this time. Counselors and vocational education teachers were also found to be sources of encouragement to students, as well as communicators of useful information.

Although parents and others encouraged apprentices to pursue their trade, only six of those interviewed said that they were "encouraged to select one trade over another." Therefore, it seems that the advice given to apprentices was usually general in nature ("You should become skilled at a trade.") rather than focused on a particular apprenticeship program ("You should become a machinist.") The selection of trade area was left up to the apprentice. In fact, for some, apprenticeship was suggested as an option among other alternatives from which the apprentice was to decide.

Twenty-three (47%) of the apprentices said that they had also been encouraged by family members, faculty, coaches, and counselors to go on to college after high school. One apprentice remarked, "When I went to high school they tried to steer you towards college because of the Vietnam War." This may have been the case for several apprentices in this sample, given that a large percentage of them are now in their twenties and would have been in high school during the Vietnam era.

Twelve (24%) apprentices were encouraged to pursue other activities after high school. These other activities were suggested mostly by parents, and they included "working for the family business," "joining the service," and "getting a good job."

Table III.7
Motivation for Applying to Apprenticeship
Telephone Interview Sample Only
(N = 49)

	(N)	Percent
Activity at Time of Apprenticeship		
Working	(34)	71
Attending School	(9)	19
Unemployed	(3)	6
Other	(2)	4
Why Apprenticeship Was Appealing		
Pay	(10)	21
Job Opportunities	(20)	42
Like the Work Better	(2)	4
Didn't Like Previous Job	(3)	6
Didn't Like Boss	(0)	0
Didn't Like Working Conditions	(0)	0
Opportunity for Training	(26)	54
Encouragement to Enter Trades in School		
Yes	(24)	49
No	(25)	51
Sources of Encouragement to Enter Trades		
Parent/Guardian	(15)	31
Other Relative or Friend	(1)	2
Counselor	(8)	16
Union Literature, Representative	(1)	2
Company Literature, Representative	(1)	2
Vocational Education Teacher	(7)	14
Other Teachers	(1)	2
State or Federal Apprenticeship Agencies	(0)	0
Community-Based Organizations	(0)	0
Encouragement to Select a Particular Trade		
Yes	(6)	12
No	(43)	88
Encouragement to Go on to College		
Yes	(23)	47
No	(26)	53
Encouragement to Pursue a Different Activity		
Yes	(12)	24
No	(34)	69

IV. Satisfaction with Apprenticeship

A. Apprentice's Job Performance Self-Rating

One of the ways to measure success in the first year of apprenticeship is to ask the apprentices how they would rate their own performance. One of the questions on the Apprenticeship Survey asks the apprentice for a self-appraisal in each of 12 job-related performance areas. The apprentice then rates himself again in each area according to his perception of how his boss would rate him. This "double rating" procedure was used to enable comparisons to be drawn between (1) self-rating and boss' expected rating, and (2) boss' expected rating and boss' actual rating. The second comparison, which was possible only for the subsample of apprentices for whom Employer Surveys were conducted, will be discussed in Chapter V.

Apprentices' self-ratings in each of the 12 areas can be compared in Figure IV.1. In general, apprentices rated themselves as either average or above average in all 12 performance areas. Looking at Table IV.1, this was also true of their estimated boss' ratings. In all but two areas, less than 10% of the apprentices rated themselves as below average or fair. The two areas in which apprentices rated themselves a bit lower were knowledge of technical information and amount of supervision needed. About 20% of the apprentices rated themselves as having less than average knowledge of technical information, and 12% gave themselves fair ratings with respect to the amount of supervision they need. In contrast, apprentices rated themselves particularly high or above average in their attendance and ability to get along with coworkers and supervisors.

A few deviations from the total-group averages were evident when the individual trade areas were compared. The groups were significantly different with respect to the ratings that they expected their boss to give them for completing assignments on time. In particular, the Machinists were more inclined to expect their boss' rating to be average rather than above average in this area.

In most cases, apprentices' self-ratings were directly related to their expected boss' ratings. The correlation coefficient or degree of association between the 12 sets of ratings was .82, which is very high (on a scale of 0 to 1.00). It was evident from looking at the percentages of responses on Table IV.1 that when there were discrepancies between the apprentice's self-rating and expected boss' rating, the boss' rating was lower. The areas in which a sizeable percentage of the total group of apprentices rated themselves higher than they expected their bosses to rate them included ability to use tools and equipment, accuracy and quality of work, and use of safe work practices.

Similar discrepancies between self-ratings and expected boss' ratings were apparent within individual trade areas. For example, Machinists were more inclined to view themselves as above average in adapting to new situations, compared to their supervisors, who the Machinists felt would consider them average in this area.

TABLE IV.1

Apprentice's Self-Rating and Expected Boss' Rating
(In Percentages*)

	TOTAL (N = 628)		Carpenters (N = 320)		Machinists (N = 265)		Auto Mechanics (N = 43)	
	Self	Boss	Self	Boss	Self	Boss	Self	Boss
Ability to Use Tools and Equipment								
Above Average	50	40	51	42	49	38	44	37
Average	46	51	45	48	47	54	51	56
Fair	2	5	3	5	2	4	5	5
Knowledge of Job Duties								
Above Average	39	33	39	34	37	30	47	44
Average	54	56	54	56	55	57	51	49
Fair	5	9	4	5	6	9	2	5
Knowledge of Technical Information								
Above Average	18	16	20	18	14	12	23	21
Average	61	60	58	59	66	63	49	53
Fair	20	19	20	18	18	20	26	21
Accuracy and Quality of Work								
Above Average	48	38	49	40	46	34	51	49
Average	46	52	45	50	48	54	47	47
Fair	4	6	4	5	3	8	2	2
Use of Safe Work Practices								
Above Average	52	43	48	39	56	46	58	49
Average	42	47	46	51	37	44	37	44
Fair	5	6	5	6	5	5	5	5
Attendance								
Above Average	74	66	77	70	69	62	72	65
Average	21	24	19	21	23	27	26	26
Fair	3	5	3	4	5	6	0	5
Getting Along With Fellow Workers								
Above Average	71	62	70	62	71	63	70	63
Average	27	31	28	32	25	30	30	33
Fair	2	2	2	2	3	3	0	2

TABLE IV.1

Apprentice's Self-Rating and Expected Boss' Rating
(In Percentages*)
(continued)

	TOTAL		Carpenters		Machinists		Auto Mechanics	
	(N = 628)		(N = 320)		(N = 265)		(N = 43)	
	Self	Boss	Self	Boss	Self	Boss	Self	Boss
Getting Along With Supervisors								
Above Average	58	52	61	54	51	46	74	65**
Average	36	38	33	36	42	43	23	28
Fair	4	5	4	5	5	6	2	5
Completing Assignments on Time								
Above Average	41	36	45	40	35	29	44	44***
Average	53	53	50	51	59	57	49	42
Fair	4	7	3	5	4	9	7	12
Amount of Supervision Needed								
Above Average	30	25	33	27	26	22	37	28
Average	55	58	54	57	57	58	51	60
Fair	12	12	12	11	12	13	12	9
Adapting to New Situations								
Above Average	43	35	45	36	39	31	51	53
Average	51	56	49	55	54	59	49	42
Fair	4	5	5	5	5	6	0	2
Performance in classroom								
Above Average	38	33	39	34	36	31	37	40
Average	52	52	50	51	53	55	56	47
Fair	5	6	5	5	5	6	2	7

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*Missing data may account for any difference between 100% and the numbers shown.

** Chi-square between self-ratings was significant ($X^2 = 10.18$, $p<.01$).

*** Chi-square between boss' ratings was significant ($X^2 = 13.11$, $p<.05$).

Figure IV.1

Apprentice's Self Rating (In Percentages*)

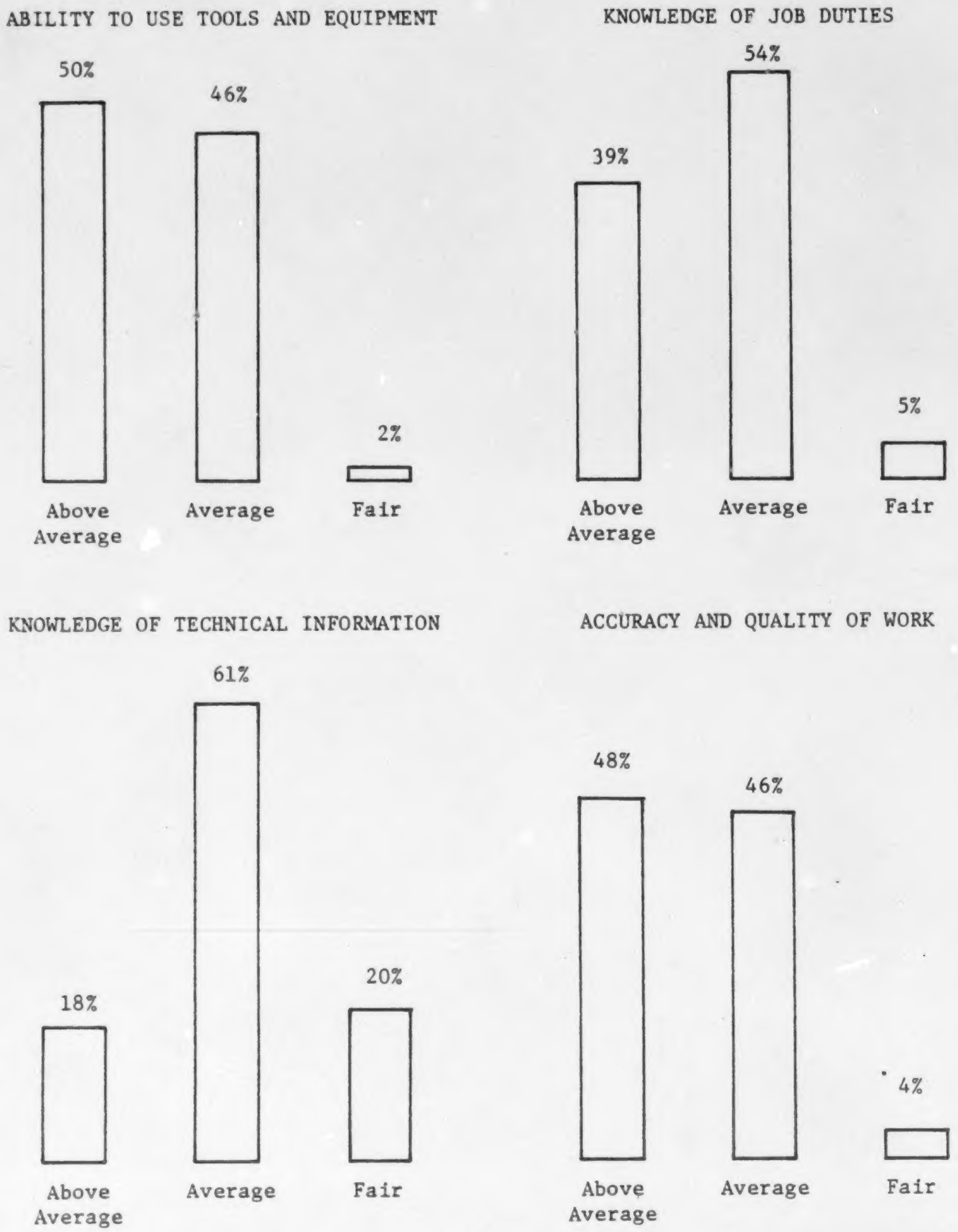


Figure IV.1 (Continued)

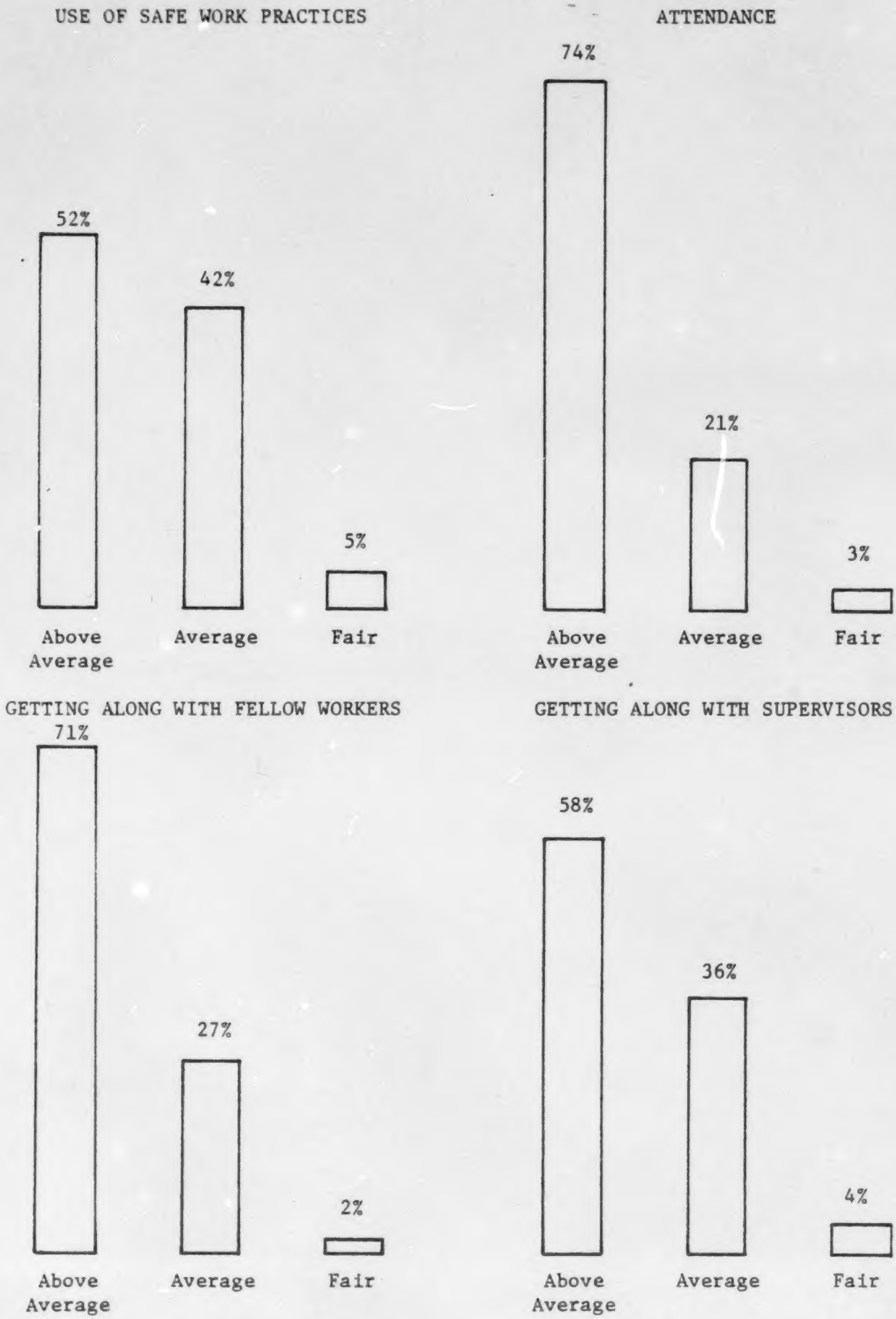
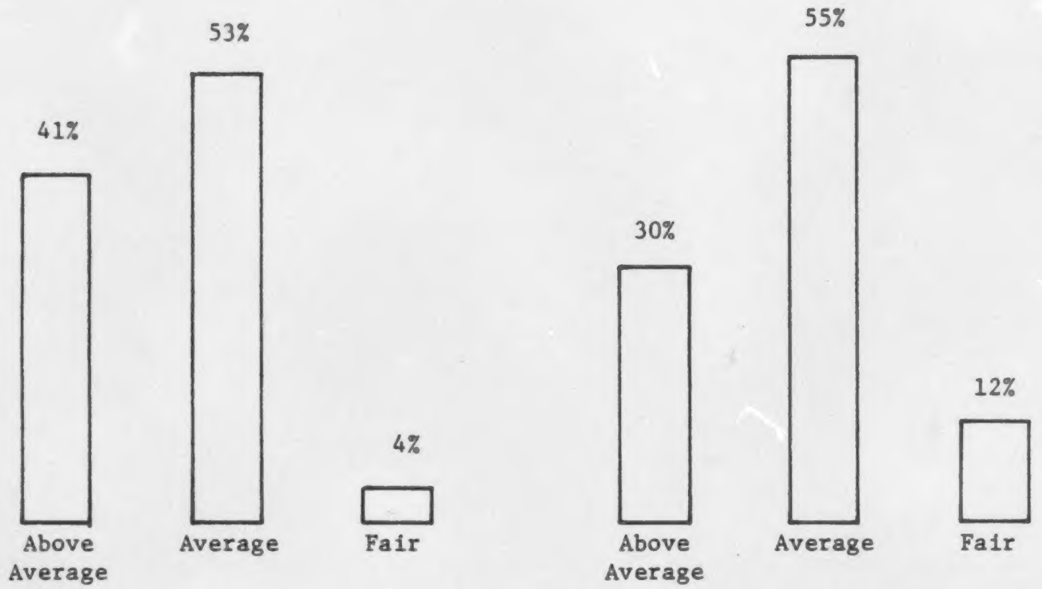
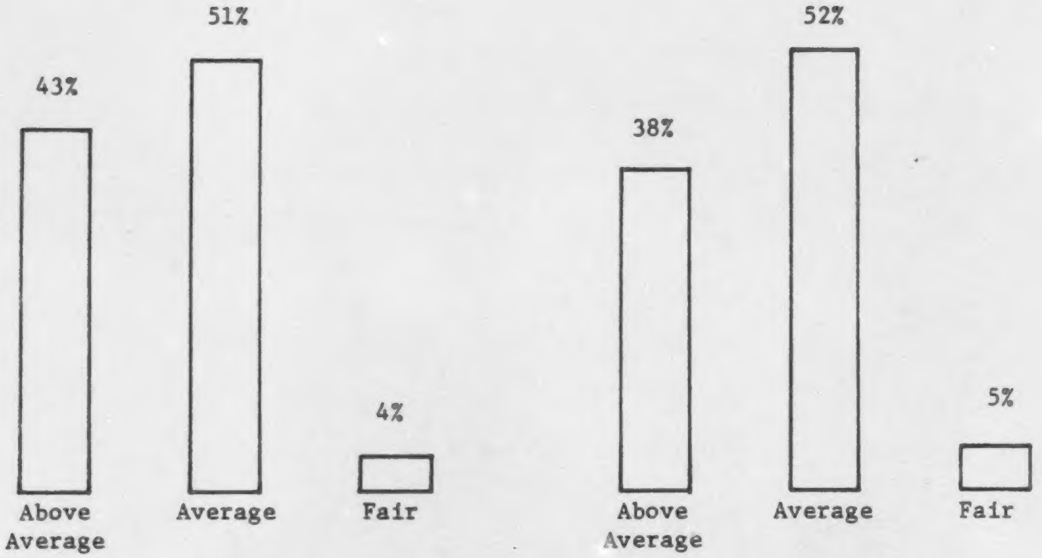


Figure IV.1 (Continued)



COMPLETING ASSIGNMENTS ON TIME

AMOUNT OF SUPERVISION NEEDED



ADJUSTING TO NEW SITUATIONS

PERFORMANCE IN CLASSROOM

B. Apprentice's Rating of the Program

In addition to rating their own performance, apprentices were asked to evaluate various aspects of their apprenticeship programs. First, they were asked to rate the pay, the working conditions, and the attitude of their employers on a five-point scale ranging from excellent to poor. Looking at the response breakdown of the total group in Figure IV.2, most apprentices rated the program as above average in all three categories--pay, working conditions, and employer's attitude. This is also reflected in the average number of points scored on this short (three-question) measure, which was 10 out of 15.

Table IV.2 shows that ratings of pay and employer's attitude vary significantly across trade areas. Carpenters are most inclined to see their pay as excellent or above average. A particularly large percentage of Auto Mechanics see their pay as either fair or poor. With respect to employer's attitude, Machinists tend to give more negative ratings than Carpenters or Auto Mechanics. Nearly one-third (31%) of the Machinists rated their employer's attitude as fair or poor.

It is interesting to note that Barocci (1972) found similar differences in apprenticeship program ratings across trade areas when researching reasons for cancellation of indenture. In the construction (carpentry) trade, apprentices dropped out more often for personal reasons and for other job opportunities than because of dissatisfaction with pay or their employer's attitude. In addition, service (Auto Mechanics) and industrial (Machinists) trade apprentices were less pleased with their pay rate and the treatment they received from employers. Because the characteristics of the employer

TABLE IV.2

Apprentices' General Rating of Apprenticeship Programs

(In Percentages*)

	Total (N = 628)	Carpenters (N = 320)	Machinists (N = 265)	Auto Mechanics (N = 43)	
Pay					
Excellent	12	17	8	7	$X^2 = 21.66$
Above Average	26	27	26	26	$(p<.05)$
Average	24	20	30	19	
Fair	20	20	20	26	
Poor	15	14	14	23	
Working Conditions					
Excellent	14	14	14	16	
Above Average	37	39	35	30	
Average	30	31	28	26	
Fair	13	12	14	16	
Poor	4	2	6	12	
Employer's Attitude					
Excellent	24	25	21	28	$X^2 = 17.27$
Above Average	28	31	25	30	$(p<.05)$
Average	22	24	20	16	
Fair	14	11	18	9	
Poor	10	7	13	16	

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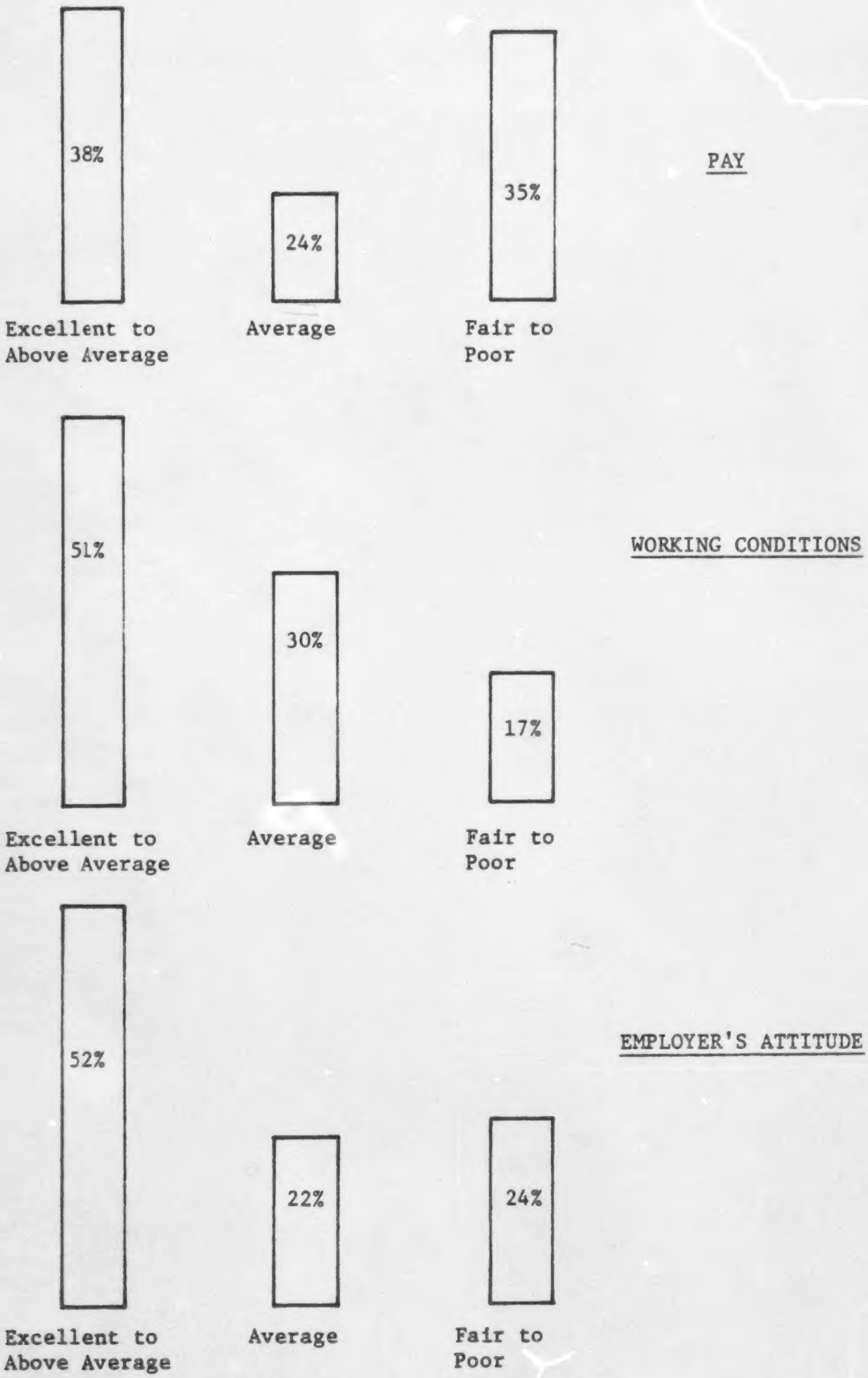
*Missing data may account for any difference between 100% and the numbers shown.

Figure IV.2

Apprentices' General Rating of Apprenticeship Programs (In Percentages*)



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*Missing data may account for any difference between 100% and the numbers shown.

are an important influence in an apprentice's decision to complete the program or drop out, Barocci suggested that educators become familar with employer characteristics and communicate them to students before they enter apprenticeship.

After evaluating their apprenticeship on the above three general dimensions, apprentices were asked to rate 12 different aspects of their programs. The following question was posed: "Thinking back over the time you spent as an apprentice, how would you rate each of these experiences?" Respondents marked a five-point scale ranging from "never" to "always" having a particular experience. In general, apprentices rated their experiences positively; out of the 60 points possible on this scale, the average score was fairly high--47 points.* The experiences and breakdowns of apprentices' responses are shown in Table IV.3. The following is a brief summary of apprentices' reactions to each statement of program experience.

> "The work assignments helped me to learn the trade." Over two thirds (69%) of the apprentices said that work assignments usually or always helped them learn the trade. There was very little variance across trade areas.
>
> "The jobs given to me were too easy." Over half (57%) of the apprentices in every trade area felt that their job assignments were sometimes too easy.

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*Scoring was done by recoding half of the responses so that positive experiences would always be assigned a higher number of points.

"I was able to ask questions and get help from my supervisor." Over three quarters (79%) of the apprentices said that they always or usually got help from their supervisors, regardless of their trade area.

"The time allowed to learn each job was too short." Some 75% of the apprentices reported that this was not usually the case.

"I knew how well I was doing on the job." Nearly two thirds (64%) of the apprentices said that they usually or always knew how well they were doing. Percentages are similar in all three trades.

"The jobs given to me were too hard." Over half (55%) of the apprentices said that this was never true, and almost all of the rest (39%) said that only occasionally were job assignments too difficult. There was little variance across trade areas.

"My classroom instruction was useful on the job." Apprentices were split in their reactions to this statement. While nearly half (45%) of them felt that what they learned in class was usually or always useful, a sizeable number (35%) of them said that this was only sometimes or never the case. Auto Mechanics were particularly negative in their assessments with 19% of them reporting that their classroom instruction was never useful on the job.

"Classroom courses were too hard." All but a handful of apprentices (89%) said that this was never or only sometimes true. Very few apprentices in any trade area felt that their courses were too difficult.

"The tools, equipment, and materials in the classroom were similar to those on the job." One half of the apprentices said that their classrooms were always or usually supplied with the tools, equipment, and materials used on the job. Percentages were similar across trade areas.

"Classroom courses were too easy." About two thirds (67%) of the apprentices said their courses were never or only sometimes too easy. Very few apprentices in any trade area judged their courses to be too easy.

"The teacher explained things well." The majority (58%) of apprentices felt that their teachers always or usually provided good explanations. Carpenters were particularly positive in their ratings of teachers.

"Books used in the courses were too hard to understand." Only a small percentage of apprentices found their books to be too hard. Some 88% of them said that they had never or only occasionally encountered books that were too difficult. Carpenters were especially positive in their assessment of textbook difficulty; 61% of them said that their books were never too hard.

It can be concluded from the reactions to these 12 statements that, in general, apprentices were pleased with their work assignments, and although they sometimes found them too easy they were seldom too difficult. Apprentices felt that they were usually given enough time to learn jobs and that they could get help from their supervisors. They had a good idea of how well they were doing most of the time. With respect to their classroom courses, few apprentices found the courses too difficult or too easy; it can be inferred that the level of instruction was about right. Apprentices' assessments of their teachers and textbooks were also generally positive. The tools, equipment, and materials used in the classroom were reported to be similar to those used on the job by about half of the people in each trade area. In addition, only half of the apprentices judged their classroom instruction to be relevant to their jobs; many of them said that what was learned in courses was seldom useful.

TABLE IV.3

Apprentices' Rating of Apprenticeship Experiences (In Percentages*)

	Total (N = 628)	Carpenters (N = 320)	Machinists (N = 265)	Auto Mechanics (N = 43)
Work Assignments Helped Learn Trade				
Never	1	(.3)	2	0
Sometimes	14	17	11	14
Half the Time	13	13	14	5
Usually	41	42	40	42
Always	28	26	29	40
Job Assignments Too Easy				
Never	10	12	8	12
Sometimes	57	54	60	60
Half the Time	21	21	21	23
Usually	7	8	7	5
Always	1	1	1	0
Able to Ask Questions & Get Supervisor's Help				
Never	2	1	2	5
Sometimes	11	8	12	14
Half the Time	7	7	8	5
Usually	28	29	25	33
Always	51	53	50	44
Time to Learn Jobs Too Short				
Never	33	33	33	33
Sometimes	42	43	42	42
Half the Time	13	14	11	14
Usually	7	5	9	9
Always	2	2	2	2
Knew How Well Was Doing				
Never	5	5	4	5
Sometimes	15	17	14	5
Half the Time	14	13	16	9
Usually	47	46	46	58
Always	17	17	17	19

TABLE IV.3

Apprentices' Rating of Apprenticeship Experiences
(In Percentages*)
(continued)

	Total (N = 628)	Carpenters (N = 320)	Machinists (N = 265)	Auto Mechanics (N = 43)	
Job Assignments Too Hard					
Never	55	57	51	60	
Sometimes	39	37	42	33	
Half the Time	3	3	3	5	
Usually	(.3)	(.3)	(.4)	0	
Always	(.3)	(.3)	0	2	
Classroom Instruction Useful on Job					
Never	6	7	3	19	$X^2 = 27.86$
Sometimes	29	27	33	14	($p<.01$)
Half the Time	14	13	16	7	
Usually	26	26	26	23	
Always	19	22	16	26	
Classroom Courses Too Hard					
Never	59	63	55	56	
Sometimes	30	28	32	30	
Half the Time	5	5	5	0	
Usually	1	0	1	2	
Always	(.5)	(.3)	1	0	
Classroom Tools Similar to Those on the Job					
Never	10	9	12	12	
Sometimes	20	20	20	21	
Half the Time	12	13	13	5	
Usually	30	29	29	33	
Always	20	23	17	16	
Classroom Courses Too Easy					
Never	23	24	21	26	
Sometimes	44	43	45	42	
Half the Time	16	16	17	14	
Usually	8	9	8	0	
Always	4	4	3	5	

TABLE IV.3

Apprentices' Rating of Apprenticeship Experiences
(In Percentages*)
(continued)

	Total (N = 628)	Carpenters (N = 320)	Machinists (N = 265)	Auto Mechanics (N = 43)	
Teacher Explained Things Well					
Never	5	4	5	7	$X^2 = 25.00$
Sometimes	17	16	17	21	$p<.01$)
Half the Time	13	10	18	5	
Usually	37	38	36	35	
Always	21	27	13	19	
Book Too Hard					
Never	52	61	42	42	$X^2 = 24.42$
Sometimes	36	31	43	37	($p<.01$)
Half the Time	4	2	6	5	
Usually	1	1	2	0	
Always	1	1	1	0	

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*Missing data may account for any difference between 100% and the numbers shown.

V. Employer's Experience with Apprentices

A. Employer's Rating of Apprentice

1. Performance on the Job

As mentioned earlier, the Employer Survey included questions about particular apprentices as well as apprentices in general. First, employers were asked to rate the apprentice who had answered the Apprenticeship Survey in each of 12 performance areas; employers' ratings were on a three-point scale (above average, average, or fair). A total of 11 Carpenter, 16 Machinist, and one Auto Mechanic employer completed this part of the survey. Because the number of employers representing each trade was so small, the discussion of their responses will focus on the total group of 28.

The employers' ratings are displayed in percentages in Table V.1. In general, most supervisors rated their apprentices as average in all but 2 of the 12 areas: Ability to use tools and equipment and attendance were areas in which they were rated as above average. The only areas in which a sizeable percentage of employers felt that apprentices were below average or fair was their knowledge of technical information.

When these employers' actual ratings were compared to the expected employer ratings appearing in parentheses (Table IV.1), they were found to be very similar. Over all 12 areas, it was evident that there was a high degree of correspondence between the apprentices' expected ratings and the actual employer ratings in terms of the percentages of people choosing each of the three ratings. However, there were a few performance areas in which the ratings did not correlate as well. Ability to use tools and equipment was the one area in which this discrepancy was evident; while most apprentices

TABLE V.1

Actual Employer Ratings of Apprentices and Expected Employer Ratings (in parentheses) (In Percentages*)

Ability to Use Tools and Equipment	
Above Average	57 (40)
Average	39 (51)
Fair	4 (5)
Knowledge of Job Duties	
Above Average	36 (33)
Average	57 (56)
Fair	4 (9)
Knowledge of Technical Information	
Above Average	18 (16)
Average	61 (60)
Fair	21 (19)
Accuracy and Quality of Work	
Above Average	43 (38)
Average	50 (52)
Fair	7 (6)
Use of Safe Work Practices	
Above Average	29 (43)
Average	64 (47)
Fair	9 (6)
Attendance	
Above Average	57 (66)
Average	32 (24)
Fair	11 (5)
Getting Along With Fellow Workers	
Above Average	39 (62)
Average	50 (31)
Fair	11 (2)
Getting Along With Supervisors	
Above Average	43 (52)
Average	54 (38)
Fair	4 (5)
Completing Assignments on Time	
Above Average	25 (36)
Average	61 (53)
Fair	14 (7)
Amount of Supervision Needed	
Above Average	32 (25)
Average	64 (58)
Fair	4 (12)
Adapting to New Situations	
Above Average	39 (35)
Average	50 (56)
Fair	11 (5)
Performance in Classrooom	
Above Average	21 (33)
Average	39 (52)
Fair	7 (6)

---

*Missing data may account for any difference between 100% and the numbers shown.

expected average ratings, most of their bosses viewed them as above average. On the other hand, there were other areas in which the trend was in the opposite direction. Use of safe work practices and getting along with fellow workers were two areas in which a sizeable percentage of apprentices expected their bosses to rate them as above average, but in reality they were perceived to be just average.

In addition to comparing the percentages of different responses to the 12 performance ratings, the extent of agreement between the apprentice's expected rating and the boss' actual rating were compared by examining overall ratings. Overall ratings could be computed by simply adding the 12 individual ratings, which ranged from 1 to 3, to produce a scale ranging from 12 to 36. Then the overall ratings for the 25 apprentices who had both expected and actual data available were compared by looking at the pairs of ratings for each individual. The absolute differences between pairs ranged from 1 to 11 points and the mean absolute difference was 5 points.

Although a five-point difference in ratings may appear to be a small one, it is actually quite large when one considers that on an already somewhat restricted scale of 12 to 36 points, the scores only ranged from 12 to 28, with a mean score of 20 points for both apprentices and employers. The standard deviations of these approximately normal distributions were small; only three points for apprentices and four points for employers. This means that 68% of the scores on this scale fell between 17 and 23 points on the Apprenticeship Survey and 16 and 24 on the Employer Survey. Therefore, because the scores were so tightly clustered around the mean in each distribution, a mean absolute difference of five points between distributions was seen to be quite large. Furthermore, because the paired scores did not vary consistently in one direction, the correlation coefficient between them was low ($r=-.073$). It could be concluded that the scores were not spread broadly enough to determine the actual degree of relationship between the apprentice's expected rating in overall performance and the overall rating which his boss awarded him.

2. Need for Improvement

In addition to rating apprentices in each of the 12 performance areas, employers were asked to complete a second set of ratings about the particular apprentice who had answered the Apprenticeship Survey. This time, the ratings involved four areas in which the employer might have felt that the apprentice needed improvement. The table below shows the percentages of employers who gave each rating. Over half of the employers felt that apprentices needed some improvement in basic English and math. Smaller percentages of employers reported apprentices needing improvement in either basic knowledge of the trade or work attitudes.

TABLE V.2

Employer Ratings of Areas in Which Apprentices Need Improvement (In Percentages)

	Needs No Improvement	Needs Some Improvement	Needs a Lot of Improvement
Basic English (Reading and Writing)	36	59	4
Basic Math	44	56	0
Basic Knowledge of the Trade	54	36	11
Work Attitudes	68	25	7

Each apprentice's self-rating in terms of high school grades and ability in each of the above areas was paired with the employer's rating in order to determine their relationship. Because high school grades, apprentice's self-rating of ability, and employer ratings were on different scales, all responses were converted to a common three-point, high-medium-low scale for ease of comparison.* These high-medium-low pairings were tallied, and Table V.3 was produced as a summary of the degree of agreement between the apprentice's self-rating and the employers actual rating of the apprentice. This system of comparing ratings was necessary because of the small size of the employer sample (N=21 to 26); it would have been misleading to present correlation coefficients in this case. Table V.3 marginals showed that most apprentices gave themselves high ratings in every area, (particularly with respect to apprenticeship grades). In contrast, employers were split between high and average ratings in English and math but were also inclined toward high ratings in trade knowledge and work attitude.

By summing the diagonals of each of the six tallies in Table V.3, a percentage of agreement can be generated for each of the six pairs of ratings. Agreement was highest between average grade in apprenticeship and employer rating of trade knowledge (54%) and apprenticeship grades and employer rating of work attitude (69%). Apparently, the apprentices who were doing above-average work in apprenticeship classes (as reflected by their high grades) were also demonstrating above-average knowledge of their trade and above average work attitudes while on the job (as reflected by high employer ratings).

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*Scale conversion was done as follows:

1. Grades A, A-B, B = High; B-C, C = Med; C-D, D & Below = Low
2. Ability Excellent, Above Average = High; Average = Med; Fair, Poor = Low
3. Needs No Improvement = High; Needs Some Improvement = Med; Needs a Lot of Improvement = Low

TABLE V.3

Relationship between Apprentice's Self-Rating and Employer's Rating in Four Areas

Employer Rating of Basic English

Average Grade H.S. English	High	Med.	Low	Total	% Agreement
High	5	5	1	11	
Medium	3	4	0	7	
Low	1	2	0	3	
	9	11	1	21	43%

Reading Ability	High	Med.	Low	Total	% Agreement
High	2	6	0	8	
Medium	4	5	1	10	
Low	3	0	0	3	
	9	11	1	21	33%

Employer Rating of Basic Math

Average Grade H.S. Math	High	Med.	Low	Total	% Agreement
High	8	9	0	17	
Medium	3	2	0	5	
Low	1	0	0	1	
	12	11	0	23	43%

Math Ability	High	Med.	Low	Total	% Agreement
High	6	9	0	15	
Medium	4	2	0	6	
Low	1	0	0	1	
	11	11	0	22	36%

Employer Rating of Trade Knowledge

Average Grade in Apprenticeship	High	Med.	Low	Total	% Agreement
High	14	9	1	24	
Medium	1	0	1	2	
Low	0	0	0	0	
	15	9	2	26	54%

Employer Rating of Work Attitude

Average Grade in Apprenticeship	High	Med.	Low	Total	% Agreement
High	17	5	2	24	
Medium	1	1	0	2	
Low	0	0	0	0	
	18	6	2	26	69%

B. Reasons for Apprenticeship Termination

First, employers were asked, "Which of the following is the most typical reason for the termination of employment for apprentices?" The response breakdown for the 24 employers who answered this question is provided in the table below.

TABLE V.4

Most Typical Reason for Apprentice Termination

	N	Carpenters	Machinists	Auto Mechanics	Total
Fired	(10)	0	2	0	2
Quit	(12)	3	9	1	13
Laid Off	(2)	7	1	1	9
		10	12	2	24

Over one half of the employers said that terminated apprentices usually quit, although this varied by trade. For Carpenter apprentices, lay off was the most common cause of employment termination.

Next, those 10 employers who knew of apprentices having been fired were asked to rank reasons for being fired from 1 = most typical reason to 4 = least typical reason.

TABLE V.5

Reasons for Firing Apprentices

(Total Number of Responses)

	Ranking			
	Most Typical Reason (1)	(2)	(3)	Least Typical Reason (4)
Tardiness	2	2	2	3
Absenteeism	3	3	2	1
Inadequate Job Performance*	8	0	0	2
Improper Attitude or Behavior on the Job	2	4	3	0

---

*Responses total to 10 because one employer marked only Job Performance.

Because firing was so uncommon, especially among Carpenters, only nine employers completely responded to this question. It would be improper to draw inferences from such a small sample. However, it may be worthwhile to point out the fact that the most typical reason for employers firing apprentices was inadequate job performance rather than general work habits or attitudes.

In addition to investigating why apprentices were fired, employers were asked why apprentices quit the program. They rated seven reasons that apprentices gave for quitting on the three-point scale displayed below.

TABLE V.6

Reasons for Apprentices Voluntarily Quitting
(Total Number Who Checked Each*)

	Reason Often Given	Reason Occasionally Given	Reason Never Given
Felt that the pay was too low	5	6	5
Did not see enough job opportunities in the occupation	3	4	7
Did not like the apprenticeship work	1	5	8
Returned to a former job	0	5	8
Did not like his boss	0	5	8
Did not like the working conditions	2	7	6
Felt that he was not getting enough training	0	3	11

*Total number of responses vary due to missing data.

Eleven employers said that they did not know of any apprentices who voluntarily quit, so they did not respond. Once again, because only 13 employers completely responded to this question, inferences from such a small sample should be drawn only with a great deal of caution. However, it is worth noting that only infrequently were any of the seven "reasons often given" for quitting. This may be due to the fact that although quitting is the most typical reason for termination, it is still not a common phenomenon. Therefore, employers would be more inclined to see any of the reasons listed as "occasionally given" or "never given." Responses to all but one of the seven reasons were about evenly split between these two choices. However, it is clear that one reason for quitting, "felt that he was not getting enough training," was one that was reportedly almost never given by apprentices.

C. Problems Among Apprentice Employees

In addition to finding out the areas in which apprentices need improvement and why apprentices do not finish their programs, the nature of their personal problems were also investigated. Employers checked each of the following problems if they perceived them to be serious among their apprentice employees. The frequency with which each of the problems was checked is listed in the following table.

TABLE V.7

Frequency of Problems among Apprentice Employees
(Total Number Who Checked Each*)

10	Domestic problems
1	Health problems
4	Trouble with the law
0	Child care
2	Language difficulties
7	Drinking
7	Drugs
5	Transportation
7	Indebtedness
12	Improper attitude

*(N=28)

Of the 29 employers, only 16 marked any of the problems listed. While 13 of the respondents did not see any of the items on the list as applicable to their apprentices, others checked as many as eight. The average employer marked one or two items on the list as problems.

Improper attitude and domestic problems were perceived to be serious problems by the largest number of employers. Drinking, drugs, and indebtedness were mentioned by one quarter of the employers. It should be noted that child care and language difficulties were probably not problems simply because of the personal characteristics of the apprentice population. Because nearly all apprentices were male and only a small percentage had more than one dependent, child care was not likely to be a common problem. In addition, because less than 5% of the apprentices were Hispanic or non-English speaking, language difficulties were not likely to be a common problem.

D. Comments of Employers during Structured Interview

In addition to statistical data gathered and reported in previous sections of this report, ETS prepared a structured interview form to be used with each employer interviewed. Comments from each employer (N=21) were grouped by questions. The responses varied from one part of the state to another and by area vocational-technical school (AVTS) district. This report uses AVTS as an inclusive term and does not attempt to highlight a specific school or school district. Following is an explanation as to why certain questions were asked, discussion about each question, and a summary of responses.

Firmly anchored in federal and state legislation providing funds for vocational-technical schools is the provision to purchase equipment. Part of the logic is that providing modern or state-of-the-art equipment will increase students' chances for employment by giving them the opportunity to perform complicated or sophisticated job activities. To ascertain whether apprentices had an opportunity to use modern equipment in high school or after and to obtain employer perceptions of the validity of the argument that use of such equipment is important, the following question was asked.

"Are the apprentices being given training in high school on up-to-date equipment?"

Most of the employers responded yes to the specific question but qualified that response with the following statements:

> "It is the teachers that make the difference."
>
> "Some of the school's curriculum for machinists is not up-to-date."
>
> "Some schools have CNC equipment, and we cannot afford that."
>
> "It makes no real difference to us; we train them on our equipment to our own level of acceptability."
>
> "Small shops [like ours] do not use state-of-the-art, CNC, machines; what they need to teach is math and blueprint reading."
>
> "Equipment is fine, but they don't teach production work of good quality but work that is done quickly .... We don't have all day to spend making a $2.00 part look perfect."
>
> "Mathematics taught to carpenters should be framed in adult language at the adult level--not this kid's stuff".

Two questions were asked that attempted to ascertain any perceived differences in apprentices who were from AVTS and those who were students from academic programs. The first dealt with employer's perceptions of the importance of vocational training, the second with differences in work performance.

To the following question, all but one employer answered yes.

"Do you think it is [or was] important for apprentices to have [or have had] vocational training in high school prior to becoming an apprentice? Why?"

Again, there were qualifying statements.

> "Yes, if it [vocational training] is good."
>
> "Yes, but students need to be taught how to spend less time over a work piece."
>
> "Yes, because they get experience on some equipment even though it may not be exactly the same type we use here."
>
> "Yes. It is a help, but they need more math--trig especially."
>
> "Yes, because of the extra training--training that small shops cannot provide."
>
> "Yes, I do. It is a chance to survey courses--choose an area and then study an area of choice."
>
> "No. The AVTSs teach them the old single unit residential construction, and today it is largely commercial."

Employers found the second question more difficult to answer.

"Can you tell a difference in work performance between a student who had vocational training in high school vs. one who had a general or academic education? If so, how?"

Most said yes, they could tell, but only three ventured a concrete response as to how former vocational students performed better than their peers.

> "They know how to follow directions, know basic terminology, and can take orders."
>
> "They can read a blueprint."
>
> "Their behavior, attitude, and sense of responsibility."

One method of determining how to better prepare individuals for a specific position is to ask employers what they use as criteria to select new employees. This approach was used in the fourth question:

> "If you could determine the criteria for selecting apprentices, what would you rate as the most important and maybe second or third?"

Again, responses varied, with the extreme of the continuum expressed in the two following quotes:

> "We do not determine the criteria now--Someone else does."
>
> "If I could do it, I would require two years in a vo-tec school or two years in a junior college....B average, an interview, and a test."

The employers who were interviewed represented either large firms with many (20-30) apprentices or small shops with only one apprentice. The large firms drew their apprentices from among their existing employee pool, most of whom had been employed there over four years. Part of the criteria had been set (de facto) through a natural selection process, as only current employees and those with experience were in the pool from which apprentices were drawn. The large employer usually responded:

> "They work for us already. We know what they can do anyway. If they quit the apprenticeship program, they usually stay on with us."
>
> "They already know about the job, the pay, the people, and the apprenticeship program and have had time to think about applying. Usually, only the ones who know they can meet the requirements apply."

The small employer, who does not have a pool, works closely with the local AVTS to acquire apprentices. When asked about criteria, they most often responded:

"An interest in machines."

"Some mechanical comprehension."

"Willingness to start at the bottom and work up."

"High school diploma."

"Tell the schools to teach more math and how to compute angles."

"Should be sincerely interested in...this trade...make a commitment."

The questionnaires mailed to apprentices asked their opinion of the programs on at least 15 variables. Those data are reported in section IV. The project staff also wanted to know the impressions of the employers. Therefore, the following question was asked:

> "What is your general impression of the apprenticeship program? Is it a good one? Is it cost effective? What improvements would you suggest?"

For the first time in the interview process responses were given that were confusing and occasionally conflicting. Until now, the responses from employers of Machinists, Carpenters or Auto Mechanics had been homogeneous enough not to warrant separate detailed descriptions. But for this question, the responses differ enough to warrant special attention.

Auto Mechanics Apprentices: The apprenticeship classroom and laboratory training were being given at the local AVTS. Whether it was actually happening or just the impression of the employer, concern was expressed that CETA students, apprenticeship students, adult education students, and others were all grouped in the same classroom/laboratory. This practice was believed to reduce the overall quality of the apprenticeship program. Except for this one problem, the general impression of the program was good.

Carpenter Apprentices: The comments from Carpenter apprentices' employers were as follows:

"It is a good program. I was in it myself."

"The instructors in the programs could help the students improve their math skills."

"Ours is a local program run by the union. It is good."

"They should teach more commercial work. The only thing he [the instructor] is interested in is cabinet work."

Machinist Apprentices: The employers of machinist apprentices were unanimous in their approval. Realizing that the actual number of apprentices in the shop varies from company to company and from union agreement to union agreement, the employers expressed one concern. "What is going to happen when I loose Bill or Charlie or any employee; there are just not enough apprentices coming along." The sluggish economy was blamed for creating a situation whereby Machinists themselves were out of work and therefore recruiting apprentices was not possible.

The comments quoted from the interviews need to be tempered with the fact that the questions asked "What improvements would you make" and some employers may have felt a need to respond regardless of the degree of difficulty they were having with the apprenticeship program. The employers are generally pleased with the program as evidenced by their response to question #7. Employers would have more apprentices if they could and would recommend that other employers do so.

The sixth question was designed to assess the employer's view of the often alleged nepotism among apprentices. The question appeared to be ambiguous, and the responses gave no clear indication of employers' views. It is very difficult to separate out the influence a father has on his son's entering a skill trade from the actual apprentice selection process.

"My father was a (Machinist, Carpenter, and so forth), so I just followed him" was a statement often made by employers who owned small shops. The larger companies had formal application procedures, drew from the existing employer labor pool and a local population. Their responses were usually: "Everybody is related to somebody around here, so I can't really answer your question." It is obvious that no conclusion could be drawn from the responses to this question.

The seventh question was very straightforward:

"Would you have more apprentices if you could? Would you recommend that other employers do so?"

The typical responses given were:

"I can't have more, We have a one-to-one ratio now."

"Yes, definitely."

"Yes. It is the only way to replace the people who are leaving."

The responses were is every way a vote of confidence for the programs.

VI. Linkage between Vocational Education and Apprenticeship

A. Vocational Education in Comparison to Other High School Programs

1. Sources of Information about Apprenticeship

For each trade area, an analysis was done to determine whether apprentices from vocational education programs responded differently than apprentices who did not have this experience. Apprentices who described their high school program as vocational or business education were contrasted with those from academic or college preparatory programs and those from general education programs. The response distribution of each question in the survey was broken down by the three high school program types and each trade area was examined separately.

A few findings were shared by all three trade areas. For example, the former vocational education students were most likely to credit vocational education teachers as sources of useful information about trades and apprentice programs (See Table VI.1). This finding may not be surprising, but it is interesting in that it shows that high school vocational education teachers have a limited sphere of influence; that is, they seem to have little contact with non-vocational education students. An academic or general education student has little opportunity to learn about the world of apprenticeship unless he or she enters the vocational education program. Although some of the significant differences between high school program groups were common across trade areas, most of them were particular to either Carpenters or Machinists. Only the trade areas in which there were significant differences by program type will be discussed in this chapter.

Table VI.1

Percent Who Received Useful Trade Information from Vocational Education Teacher

		Academic	Voc./Bus.	General	X^2	
Carpenters		(N = 117)	(N = 136)	(N = 96)		
	Yes	3	44	18	58.01	$p<.01$
	No	97	56	82		
Machinists		(N = 61)	(N = 136)	(N = 60)		
	Yes	11	52	15	43.62	$p<.01$
	No	89	48	85		
Auto Mechanics		(N = 10)	(N = 15)	(N = 16)		
	Yes	0	47	6	11.26	$p<.01$
	No	100	53	94		

Carpenters and machinists who were in vocational education programs had another popular source of information regarding apprenticeship--their parents. Therefore, their peers in academic and general education programs not only were less likely to receive such occupational information from vocational teachers but also were less likely to get it from their parents (see table below).

Table VI.2

Percent Who Received Useful Trade Information from Parents

		Academic	Voc./Bus.	General	X^2	
Carpenters		(N = 117)	(N = 105)	(N = 96)		
	Yes	20	45	27	17.18	$p<.01$
	No	80	55	73		
Machinists		(N = 61)	(N = 136)	(N = 60)		
	Yes	15	32	23	7.07	$p<.05$
	No	85	68	77		

A third source of information about apprenticeships in all three trade areas was high school counselors. As the table below demonstrates, vocational education students relied upon their counselors much more than other students.

TABLE VI.3

Percent Who Received Useful Trade Information from High School Counselors

		Academic	Voc./Bus.	General	X^2	
Carpenters		(N = 117)	(N = 105)	(N = 96)		
	Yes	9	22	18	6.71	p<.05
	No	91	78	82		
Machinists		(N = 61)	(N = 136)	(N = 60)		
	Yes	8	26	20	8.03	p<.05
	No	89	48	85		
Auto Mechanics		(N - 10)	(N = 15)	(N = 16)		
	Yes	0	27	0	7.68	p<.05
	No	100	73	100		

2. Educational Background

Carpenter, Machinist, and Auto Mechanic apprentices who had been in academic programs in high school went on to college, but few of them completed even two years before pursuing apprenticeship careers (see Table VI.4). For the Carpenters only, those in academic high school programs were most likely to have fathers with advanced education. The fathers of these apprentices probably had a strong influence over their decision to go to college rather than pursue a career in the trades (see Table VI.5).

TABLE VI.4

Percentages of Apprentices with Each Level of Education

	Academic	Voc./Bus.	General	X^2	
Carpenters	(N = 117)	(N = 105)	(N = 96)		
Less than 4 Yrs. H.S.	1	1	3	68.54	$p<.01$
H.S. Graduate	32	59	60		
Some Bus./Trade School	6	12	14		
Some College	36	10	9		
Trade Cert. or 2-yr. Degree	9	11	7		
4-yr. College Degree	13	0	0		
Machinists	(N = 61)	(N = 136)	(N = 60)		
Less than 4 Yrs. H.S.	0	2	8	58.86	$p<.01$
H.S. Graduate	34	65	55		
Some Bus./Trade School	11	11	17		
Some College	33	6	8		
Trade Cert. or 2-yr. Degree	13	14	10		
4-yr. College Degree	7	0	0		
Auto Mechanics	(N = 10)	(N = 15)	(N = 19)		
Less than 4 Yrs. H.S.	0	20	13	18.81	$p<.05$
H.S. Graduate	20	47	63		
Some Bus./Trade School	0	13	67		
Some College	50	13	0		
Trade Cert. or 2-yr. Degree	20	7	13		
4-yr. College Degree	10	0	0		

TABLE VI.5

Percentages of Apprentices' Fathers with Each Level of Education

	Academic	Voc./Bus.	General	X^2	
Carpenters	(N = 117)	(N = 105)	(N = 96)		
Less than 4 Yrs. H.S.	21	30	27	21.85	$p<.05$
H.S. Graduate	39	50	41		
Some Bus./Trade School	6	5	2		
Some College	6	2	7		
Trade Cert. or 2-yr. Degree	5	6	7		
4-yr. College Degree	19	3	9		

Grades reported for high school English, math, and apprenticeship classes are compared by trade and high school program in Table VI.6. High school grades reported on the Apprenticeship Survey were scaled from 4 = A to 1 = D or below. Then the average grades reported in each subject area were computed for each high school program group by trade area. Looking at the column totals in Table VI.6, it is clear that, as reported in Section III E, there was not a substantial amount of variance in grades by trade area. Differences between mean grades are larger when high school programs are compared via the row totals. Apprentices from academic programs reported higher English and math grades than those from vocational or general programs. However, vocational and academic background apprentices were very similar with respect to reported math grades and grades achieved in apprenticeship courses. Although the vocational group reported slightly higher grades than the academic group in apprenticeship classes, differences were not statistically significant.

It is interesting to note that the apparent superiority of apprentices with academic backgrounds in reported English and math grades held up with respect to their self-ratings of ability in reading and math computation. Table VI.7 shows the percentage of apprentices rating their ability as above average or excellent for each high school program group by trade area. Academics made up the largest percentage of those reporting superior ability in each trade area. For example, 53% of the Carpenters from academic programs rated themselves as above average or excellent readers, and only 24% of the vocational and 32% of the general education Carpenters did so. This trend in self-ratings is evident across trade areas in both reading and math computation.

TABLE VI.6

Apprentices' Average Grades (Scaled)*

English	Carpenters	Machinists	Auto Mechanics	All Trades
Academic	2.91 (N=116)	3.02 (N=61)	2.85 (N=10)	2.93
Vocational	2.62 (N=104)	2.60 (N=136)	2.44 (N=15)	2.55
General	2.64 (N=95)	2.44 (N=60)	2.53 (N=16)	2.54
All Programs	2.72	2.69	2.61	

Math	Carpenters	Machinists	Auto Mechanics	All Trades
Academic	3.09 (N=116)	3.12 (N=60)	3.20 (N=10)	3.14
Vocational	3.21 (N=105)	3.07 (N=136)	2.84 (N=15)	3.04
General	2.81 (N=96)	2.82 (N=59)	2.85 (N=16)	2.83
All Programs	3.04	3.00	2.96	

Apprenticeship Class	Carpenters	Machinists	Auto Mechanics	All Trades
Academic	3.42 (N=105)	3.43 (N=54)	3.11 (N=9)	3.32
Vocational	3.34 (N=99)	3.42 (N=133)	3.35 (N=13)	3.37
General	2.84 (N=87)	3.30 (N=48)	3.20 (N=10)	3.11
All Programs	3.20	3.38	3.22	

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* Scoring was inverted from that which appeared on the Apprenticeship Survey so that higher scores reflect better grades on a four-point scale:

4 = A, A-B
3 = B, B-C
2 = C, C-D
1 = D or below

TABLE VI.7

Percentage of Apprentices Rating Their Ability as Above Average or Excellent

(In Percentages)

Reading Ability	Carpenters	Machinists	Auto Mechanics	
Academic	53	56	80	
Vocational	24	42	40	$X^2 = 24.05$
General	32	30	31	$p < .01$
Math Computation Ability				
Academic	73	64	70	
Vocational	55	54	27	$X^2 = 20.82$
General	34	45	31	$p < .01$

Looking at individual trades, educational background had a particularly strong effect on the self-reported grades of Carpenters. A significantly higher percentage of those from vocational/business programs reported getting top grades in math than either academic or general program students. However, as Tables VI.8 and VI.9 demonstrate, this finding conflicts with Carpenters' self-reported ability in math computation. When the apprentices rated their current ability to perform math computation, the vocational education students did not rate themselves as highly as the academic students. It seems that although the vocational student apprentices may have performed particularly well in the math courses that they took while in high school, they were less inclined to rate their math computation ability as above average than apprentices with academic backgrounds.

TABLE VI.8

Apprentices' Average Grades in Math (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Carpenters	(N = 117)	(N = 105)	(N = 96)		
A	18	27	4	42.34	$p<.01$
A - B	27	25	31		
B	30	23	18		
B - C	10	18	25		
C	12	5	14		
C - D	1	3	8		
D	2	0	0		
Below D	0	0	0		

TABLE VI.9

Apprentices' Math Computation Ability (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Carpenters	(N = 117)	(N = 105)	(N = 96)		
Excellent	23	15	9	35.67	$p<.01$
Above Average	50	40	25		
Average	27	42	58		
Fair	0	3	6		
Poor	1	0	1		

Carpenter apprentices from vocational education programs also gave themselves lower ratings in reading ability than either the academic or general education students. As Table VI.10 shows, less than a quarter of the vocational education students felt that they had above average reading ability. However, although vocational students rated themselves lower in reading than students from other programs, their overall ratings were not particularly low; over half of them said that they had at least average reading ability.

TABLE VI.10

Apprentices' Reading Ability
(In Percentages)

	Academic	Voc./Bus.	General	X^2	
Carpenters	(N = 117)	(N = 105)	(N = 96)		
Excellent	20	7	6	36.46	$p<.01$
Above Average	33	17	26		
Average	43	55	58		
Fair	3	16	9		
Poor	1	4	0		

It is interesting to note that even though Carpenter apprentices from vocational education programs differed significantly from academic and general students in their self-reported math and reading grades and abilities, their performance in apprenticeship courses was the same. Regardless of trade area, average grades reported by vocational students in apprenticeship courses were not significantly different from grades reported by other students. This may be partially explained by the fact that large percentages of non-vocational education students had some occupational training prior to apprenticeship.

Although most of the carpenters and machinists from vocational education programs reported previous occupational training, so did large percentages of those from academic and general programs (see Table VI.11). Most of these apprentices received training on the job, at skills centers, and so forth. Regardless of where this training took place, it probably helped the apprentices in their courses enough so that their lack of vocational education did not affect their performance in apprenticeship classes.

TABLE VI.11

Percentages of Apprentices with Previous Occupational Training

	Academic	Voc./Bus.	General	X^2	
Carpenters	(N = 117)	(N = 105)	(N = 96)		
Yes	36	73	54	39.19	$p < .01$
No	61	18	42		
Machinists	(N = 61)	(N = 136)	(N = 60)		
Yes	44	73	60	17.31	$p < .01$
No	48	20	37		

3. Work Experiences

Machinists from vocational education programs differed from their peers in several ways. First of all, apprentices from vocational education programs were less likely to have worked at least three years after high school than their peers from academic and general programs (see Table VI.12). This is probably due to the fact that first-year apprentices from vocational education programs were younger than those from non-vocational programs. The average age of apprentices with high school vocational education was 22 years. The mean age for apprentices from academic programs was 25 years, and the mean age for those from general programs was 27 years. It can be concluded that machinists from vocational education programs are able to enter apprenticeship at a younger age than those with other educational backgrounds.

TABLE VI.12

Years of Work Experience after High School (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
None	8	4	3	23.32	$p < .01$
Less than 1 Yr.	2	10	7		
1-2 Years	13	22	10		
2-3 Years	15	27	18		
3 or more Yrs.	62	35	60		

4. Apprentice's Self-Assessment and Satisfaction with Apprenticeship

Machinist apprentices with vocational education backgrounds differed from those with academic and general education with respect to their self-ratings and expected boss' ratings in several different areas. First, as the following table illustrates, vocational education apprentices were most inclined to say that their bosses would rate them above average in the accuracy and quality of their work.

TABLE VI.13

Expected Boss' Rating of Accuracy and Quality of Work (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Above Average	21	45	23	16.41	$p < .01$
Average	72	46	58		
Fair	7	7	12		

Secondly, vocational education apprentices were most inclined to rate themselves as average or above average with respect to their knowledge of technical information. Their expected boss' ratings are displayed on the following page.

TABLE VI.14

Expected Boss' Rating of Knowledge of Technical Information (In Percentages)

	Academic	Voc./Bus.	General	χ^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Above Average	13	13	8	9.79	$p < .05$
Average	64	71	53		
Fair	23	15	33		

Machinists from vocational education programs also had higher self-ratings and expected boss' ratings in attendance than their peers (see Table VI.15). However, it must be kept in mind that the data were based on the apprentices' self-reports, not actual attendance records.

TABLE VI.15

Self-Ratings of Attendance (In Percentages)

	Academic	Voc./Bus.	General	χ^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Above Average	57	80	63	15.39	$p < .01$
Average	33	18	28		
Fair	10	1	7		

Expected Boss' Rating of Attendance (In Percentages)

	Academic	Voc./Bus.	General	χ^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Above Average	54	73	48	17.86	$p < .01$
Average	33	20	40		
Fair	13	4	5		

Machinists who were former vocational education students were also most inclined to have above average self-ratings and expected boss' ratings in another area--getting along with supervisors. As Table VI.16 demonstrates, a large percentage of this group perceives their relations with supervisors to be above average. Once again, the data are based on the apprentices' perceptions, not the actual supervisor's assessment of the relationship.

TABLE VI.16

Self-Rating of Getting Along with Supervisor (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Above Average	41	60	47	17.35	$p < .01$
Average	52	38	40		
Fair	5	1	13		

Expected Boss' Rating of Apprentice's Relationship with Supervisor (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Above Average	38	55	40	14.63	$p < .01$
Average	54	40	42		
Fair	7	2	13		

Machinists from vocational education programs also perceived themselves as above average with respect to the amount of supervision they need while on the job. Although the above-average percentage was not particularly high (see tables on the following page), it was considerably higher than comparable percentages for former academic and general education students.

TABLE VI.17

Self-Rating of Amount of Supervision Needed (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Above Average	16	35	17	11.10	$p < .01$
Average	66	53	62		
Fair	11	11	18		

Expected Boss' Rating of Amount of Supervision Needed (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Above Average	11	31	13	14.01	$p < .01$
Average	70	55	58		
Fair	13	11	20		

Another area in which apprentices with vocational education backgrounds were different from those with academic and general education was their rating of the apprenticeship program. Machinists from vocational education programs rated their working conditions higher than other apprentices. Note in Table VI.18 that a particularly large percentage of apprentices from academic programs felt that their working conditions were poor. This finding supports that of a previous study in which it was shown that apprentices with more education (over 12 years of schooling) are more likely to be dissatisfied and drop out of the program than their (non-academic) peers (Barocci, 1972).

TABLE VI.18

Rating of Apprenticeship Program Working Conditions (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Excellent	20	15	8	20.61	$p < .01$
Above Average	28	40	35		
Average	28	28	30		
Fair	8	14	18		
Poor	16	2	5		

Thus far, this section has included only data about Machinists because they were the only trade group in which not only were the high school program groups significantly different, but in every case the difference favored vocational education students. Carpenters were another trade group in which there were a few statistically significant differences by program. However, in this group the differences favored apprentices from academic/ college preparatory backgrounds. One such difference was in their self-rating and expected boss' rating of classroom performance. As Table VI.19 demonstrates, those in the academic group were most likely to rate themselves as above average in the apprenticeship classroom.

TABLE VI.19

Self-Rating of Classroom Performance (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Carpenters	(N = 117)	(N = 105)	(N = 96)		
Above Average	53	34	29	19.02	$p < .01$
Average	41	54	57		
Fair	1	8	8		

Expected Boss' Rating of Classroom Performance (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Capenters	(N = 117)	(N = 105)	(N = 96)		
Above Average	44	31	25	13.68	$p < .01$
Average	43	52	59		
Fair	2	9	6		

The other two areas in which Carpenters from academic programs viewed themselves differently than their fellow apprentices were also related to the classroom part of apprenticeship--that is, courses and books. Nearly three quarters (74%) of the former academic students said that their apprenticeship courses were never too hard and their books were never too hard (see Tables VI.20 and VI.21). It is interesting to note that the academic group did not appear to be at an advantage with respect to the on-the-job aspects of apprenticeship.

TABLE VI.20

Apprentice's Rating of Statement "Classroom Courses Too Hard" (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Carpenters	(N = 117)	(N = 105)	(N = 96)		
Never	74	57	55	15.89	$p < .05$
Sometimes	18	36	32		
Half the Time	3	4	8		
Usually	0	0	0		
Always	1	0	0		

TABLE VI.21

Apprentice's Rating of Statement "Books Used in Courses Were Too Hard to Understand" (In Percentages)

Carpenters	(N = 117)	(N = 108)	(N = 96)		
Never	74	53	55	18.19	$p < .05$
Sometimes	21	37	36		
Half the Time	1	5	1		
Usually	0	2	2		
Always	1	0	1		

5. Personal Characteristics

High school program was also related to a difference in certain personal characteristics of Machinists. Although only 13 of over 200 Machinists were females, it is interesting to note that 8 of the 13 were from academic high school programs. Table VI.22 illustrates that a significantly greater number of the women apprentices were from academic high school programs. This sex-by-program effect was not present for Carpenters or Auto Mechanics. The 17 female Carpenters were equally representative of academic, vocational, and general high school programs. Because there were only two female Auto Mechanics, this breakdown by program was not possible.

TABLE VI.22

Apprentice's Sex by High School Program (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Female	13	2	3	10.85	$p < .01$
Male	87	98	95		

Another personal characteristic of Machinists which varied by high school program was marital status. Apprentices from vocational education programs were more likely to be single both at the time they applied to the program and when they completed the Apprenticeship Survey than their peers from other programs (see Tables VI.23). This finding is probably related to the earlier finding that the apprentices with vocational education backgrounds were younger than their fellow first-year apprentices. However, it is interesting to note that vocational education affected the way in which these Machinists began their careers. It appears that they had at least two advantages over their peers when they began their apprenticeships: They had a headstart because they were younger, and they did not have the responsibility of dependents.

TABLE VI.23

Marital Status at Time of Apprenticeship Application (In Percentages)

Machinists	Academic	Voc./Bus.	General	X^2	
	(N = 61)	(N = 136)	(N = 60)		
Single	64	73	48	13.53	$p < .05$
Married	33	22	45		
Divorced/Separated	3	1	3		
Widowed	0	0	0		

Marital Status during First Year of Apprenticeship (In Percentages)

Machinists	Academic	Voc./Bus.	General	X^2	
	(N = 61)	(N = 136)	(N = 60)		
Single	57	74	45	18.35	$p < .01$
Married	34	23	42		
Divorced/Separated	8	1	5		
Widowed	0	0	0		

Machinists from different educational backgrounds also varied with respect to union membership during these time periods. Both at the time of application to the program and when the Apprenticeship Survey was completed, apprentices from academic backgrounds were a group with a significantly greater number of union members (see Table VI.24). Those with vocational education training had the fewest union members.

TABLE VI.24

Percent of Union Members at Time of Application (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Yes	33	16	20	7.01	$p < .05$
No	67	84	78		

Percent of Union Members Currently (In Percentages)

	Academic	Voc./Bus.	General	X^2	
Machinists	(N = 61)	(N = 136)	(N = 60)		
Yes	43	24	28	6.80	$p < .05$
No	56	74	70		

B. Recommended Improvements to High School Programs

As part of the Telephone Interview, apprentices were asked for personal evaluations of their high school experiences that related to the apprenticeship program. The following question was posed: "As you think back to high school, what about your high school experience helped you to be accepted into the apprentice program?" The responses of the Carpenter and Machinist apprentices* who were called were very similar; both groups stressed the importance of vocational education courses in their high school experience. The specific vocational education courses that Carpenters thought were helpful were carpentry, woodshop, drafting, sheet metal, and home improvement. The Machinists mentioned machine shop and welding. The non-vocational course that both Carpenters and Machinists viewed as most beneficial was math. Algebra and geometry in particular were mentioned by a few Machinists. Other courses noted as beneficial to apprenticeship in these two trade areas were science and physics.

Several apprentices who were in academic high school programs felt that their college preparatory experience was advantageous to their apprenticeship careers. Some commented that good grades and a high school diploma were also to their advantage when applying for a position in the trades.

Both Carpenter and Machinist apprentices criticized their high school guidance counselors for not telling them about apprenticeship programs. Counselors were described as focusing "everything on college." However, one apprentice who was telephoned credited a high school counselor with finding him his apprenticeship job. Other sources of trade information given by the telephone interviewees were teachers and industrial trade pamphlets.

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*Only one Auto Mechanic was reached for the Telephone Interview.

Some of the apprentices who participated in the Telephone Interview could not think of anything about their high school experience that helped to pave the way into apprenticeship. Two of the apprentices said that their high school experience dated back 15 years or more and that it was too difficult to remember. However, years of general work experience, work in the specific trade area, and service in the military were mentioned as door openers. A few apprentices felt that they could attribute their progress only to their personal interest and motivation in the trade area.

After finding out what high school experiences were helpful, the telephone interviewers asked the apprentices for their suggestions for improvements in high school programs. Apprentices were asked, "What do you think the high school could do to help people to become apprentices?" Although a couple of the Carpenters and a small group of the Machinists said that their high schools had vocational schools and were already doing a good job, most apprentices provided suggestions for improvement. The most popular suggestion was, "High schools should provide students with more information about apprenticeship." Suggestions included holding seminars regarding such programs, inviting people who have gone through apprenticeship to meet with students, and providing films and lectures regarding apprenticeship. Some interviewees felt that guidance counselors were myopic in their focus on channeling high school students into college; that is, counselors should consider non-white collar careers as well.

The other major area in which apprentices felt high school education needed improvement was in the quality and variety of vocational education programs offered. Most apprentices were of the same opinion as one apprentice who remarked, "High schools teach the basics, but they could teach much more." Both Carpenters and Machinists felt that vocational education programs needed more support from the high schools and that there should be a "closer link" between the two. Adding shop courses, expanding vocational education programs, and enhancing the quality of instruction were frequently suggested. Some apprentices felt that more co-op programs should be offered and that apprenticeship should begin in high school. It was suggested that schools place students in companies that offer apprenticeship programs. One interviewee commented, "High schools cannot teach apprenticeship skills; they must be learned on the job."

While one apprentice felt that restrictions for entering apprenticeship should be loosened (for example, requiring Algebra I and II as prerequisite courses), others felt that future apprentices should be given more math instruction while in high school. Those of the latter opinion said that more emphasis should be placed on non-vocational courses such as history and science.

It should be pointed out that although apprentices offered contrasting views regarding the importance of emphasizing vocational education versus basic education, the relative popularity of each opinion was clear. The majority of Carpenters and Machinists made statements concerning the importance of high school vocational courses; therefore, it can be inferred that most of these apprentices feel that high schools are doing a satisfactory job in basic education.

VII. Determinants of First-Year Apprenticeship Achievement

A. Rationale behind Path Analysis

One objective of the apprentice survey was to explore the determinants of success in the first year of an apprenticeship. In the absence of a well-controlled experiment, it is always very difficult to ascertain how any particular treatment influences outcome. If we could randomly assign students to vocational and regular high schools, being certain that the full range of abilities, interests, and family background variables are represented in both groups, then we could evaluate the relative effectiveness of each by measuring success in the apprenticeship coursework and on the job. But true experiments are rare in education simply because we cannot control people's lives for the sake of research. A considerable amount of research has been done, however, on data obtained through observation of natural processes, and justifiable inferences regarding causation can often be drawn. Blalock (1964) discusses the major problems in studying causation and some techniques for modeling causal processes.

In many studies of the determinants of success in school or a job, investigators examine the correlations between the success criteria and variables used for prediction. Correlations alone can yield very misleading conclusions for two reasons. First, the value of a correlation depends on two things--the true relationship between the variables being measured, and the reliabilities of the measures. For many kinds of variables, such as age and body weight, the reliabilites are quite high. But for other variables, such as attitudes and abilities, reliabilities are much lower. A correlation coefficient is limited by that reliability.

Suppose the correlation between a scale on work performance were correlated .4 with a scale on attitude towards work and correlated .8 with age. Could we conclude that work performance is more closely related to age than to attitude? We could not because the attitudinal scale contains more measurement error. Attitude may, in fact, be a more important determinant of work performance than age, and the true correlation is attenuated by measurement error. We cannot know from a single correlation. Procedures for estimating measurement error and making appropriate "corrections for attenuation" are available, and in our analysis we applied such methods so we could obtain statistical estimates of "true" relationships between variables.

The second reason correlations can yield misleading conclusions is that they may be spurious. Werts (1970), for example, found in his reanalysis of Project Talent data that the correlation between student performance and per-pupil expenditure can be entirely explained by correlations with SES of the family. Parents with higher income and more education have children with better verbal ability who perform better in school because of the education they receive at home. Those same families spend more money on education. Controlling for SES, there is no evidence that per-pupil expenditure affects student performance.

Avoidance of spurious correlations and the erroneous conclusions that may follow depend not upon the statistics that are used but upon the conceptual model underlying those statistics. Mathematics can never prove, or even suggest, causation. Yet we are unwilling to ignore causal interpretations of statistical data because causation is nearly always our primary concern. We are not simply curious about the relationship between high school English grades and success in an apprenticeship. We want to know if reading and writing abilities affect performance in an apprenticeship.

A meaningful and useful causal analysis requires a model based upon careful thought and prior research findings in order to avoid spurious correlations. It must then be "testable," meaning that some appropriate mathematical procedure must be applied to test whether the proposed model fits the data. If the fit is poor, we reject the model and often test an alternate model or one that is a reasonable modification of the first. If it fits, we may conclude that the causal processes we hypothesized are accurate representations of reality. We must also realize that, as in every scientific endeavor, other models that we did not test may explain the data equally well and that there may be other important influences operating that we never measured.

We tested our model with a confirmatory factor analysis using COFAMM (Sorbom and Joreskog, 1976). This was an appropriate procedure because it made corrections for measurement error and estimated the true relationships between all of the variables. The final "path coefficients" were computed using multiple regression.

B. Choice of Variables for the Path Analysis

We obtained the data for the path analysis exclusively from the Apprentice Survey. When we developed the questionnaire, we had in mind an analysis model in which background variables (such as parents' education) and high school experiences and achievement would affect apprenticeship grades and job performance. For various reasons discussed earlier, we were unable to survey apprentices who failed in their first year of training. We could not, therefore, compare the background and training of successful first-year apprentices with unsuccessful ones. All that we did have available were the survey responses from successful first-year apprentices, most of whom were employed. Assuming that some apprentices are more successful than others, we designed two questionnaire scales to measure degree of success on the job and two to measure classroom achievement. One scale required a self-assessment of abilities such as using tools and equipment and getting along with fellow workers and supervisors. Another scale paralleled the first and asked how their boss would rate them on the same traits. The reasons for using two scales instead of one will be discussed later.

The greatest weakness of self-ratings as criteria of success is clear: Because they are self-reports, ratings are likely to be haloed (slightly higher than true performance would indicate), and some may even be false. Past studies have shown, however, that respondents are generally honest in their self-reports even though they may tend to halo their abilities. In a study by Creech and Grandy (1973), a sample of auto mechanics rated their own skills on a variety of car repair tasks. Independently, their supervisors rated them on the same tasks. Correlations between mechanic and supervisor ratings were high, and furthermore, the mechanics' self-ratings correlated significantly with their scores on the General Auto Mechanics Examination.

Similarly, Baird (1976) found in his review of numerous studies of the validity of self-reports that student reports of high school grades correlated very highly with actual grades (over .80 for individual subjects and over .90 for grade-point average). When the questionnaire asked for actual grades or averages, there was little if any halo effect. Boldt (1973) found that when 4,200 students were asked their grades in specific subjects, 79% reported them exactly right, and 98% of the grades were either exactly right or only off by one. Baird reviewed other studies in which the respondent was asked to rate his/her ability in some area. When the ability had no numeric scale (such as grade) associated with it, there was a greater tendency to halo the response and for the scale to have less reliability. Even so, they correlated well with concurrent measures such as grades and IQ.

Ratings of ability also appear to be reflections of self-concept as well as objective indicators of performance. Brookover (1962) developed a scale of self-concept of academic ability, and several studies (summarized by Baird) showed it to be a better predictor of college grades than the SAT or other admissions tests.

Because other researchers consistently found self-reports to be valid and reliable, we included in our questionnaire self-ratings of reading ability and mathematics computation ability as well as grades in English, mathematics, and first-year apprenticeship courses. In addition, we expected the self-ratings of job performance to have some credibility, although we would have preferred to have independent external measures of all these variables to supplement the self-ratings.

To minimize measurement error we built scales to have reliabilities as high as possible. For example, in question L (See Appendix A), we asked how much information respondents were able to obtain about their trade before entering the apprenticeship. We then listed eight aspects of a trade and had them rate each aspect--such as working conditions and rate of pay. The total score, consisting of the sum of the responses to all eight parts, has considerably higher reliability (less measurement error) than a single question would have.

In addition to creating reliable scales, we designed two or more scales to measure each variable we wished to assess. By having multiple measures of each variable, we were able to estimate the amount of measurement error in each and thereby correct for it.

From the questionnaire items we defined 29 variables that were suitable for use in the path analysis. One important background variable was socioeconomic status (SES). Nearly all studies of academic growth have shown SES to be an important background variable positively associated with grades, IQ, aptitude and achievement test scores, and achievement motivation (for example, see Lavin, 1965). Ideally, a measure of parents' income would be included in an SES index, but because of the nature of our survey, we decided not to ask for such personal information. Instead, we hypothesized that the parents' education and occupations could be combined into one or two SES constructs. Occupational status (item P) was coded using the DOT occupational codes (Dictionary of Occupational Titles, 1977). Historically, the Department of Labor developed these codes as indicators of work requirements including training time, aptitudes, interests, temperaments, physical demands, working conditions, work performed, and industry. They have come to be one indicator of occupational status, though certainly not the only one.

Other demographic variables that we thought might affect job performance were age and number of dependents, insofar as they might reflect maturity and responsibility.

The remaining predictors included trade-related experiences during and after high school, verbal and quantitative abilities, sources of information and influence, and performance in the apprenticeship itself.

The first of these--trade-related experiences--consisted of items E, F, G, H, and I. The amount of time spent at relevant activities such as work, hobbies, or clubs could be strong predictors of later job success. Much research has shown that time on task is important to the mastery of any skill. Whether time spent at hobbies, clubs, and work would form a single factor or more than one factor was not important. The items were designed to test the model either way.

Verbal and quantiative abilities were assessed by asking the respondent to recall high school grade averages and to make an estimate of present abilities. We expected verbal abilities--English grades and reading ability--to form a single construct. Grades in high school mathematics courses, on the other hand, may be a troublesome variable because courses differ greatly in content and difficulty, and because mathematics ability is strongly dependent on practice and tends to change over time. We also asked for a self-estimate of mathematics computation ability, since that aspect of mathematics is most closely job-related. Then in testing our model we allowed for two possible different math constructs--one in which math computation and math grades measure the same ability, and one in which math computation is part of a more recent activity requiring computation skills--namely, the apprenticeship coursework.

Sources of information and influence were items J, K, and L. The number of sources of useful information about trades and apprenticeships during and after high school were summed separately producing two scale scores. Item L was summed to produce a scale indicating the amount of information they had about their trade before entering the apprenticeship. We treated item J as a dichotomous variable scoring it '1' if they had friends or relatives in the trade and '0' if they did not. Whether information and influence would be one or more factors again was not crucial. We expected to have two or more of these measures load on a factor(s) that could be called "information about trade."

Performance in apprenticeship classes was assessed simply by asking for first-year average course grade. The measures of job performance consisted of the two rating scales in item M. One asked for the respondent's rating of himself and the other asked how his boss would rate him. We expected the two scales to be correlated, and the extent to which they did not correlate we treated as measurement error. The remaining questions about the program itself (scales N and O) reflected both the quality of the program and the apprentice's performance in it. We treated this program evaluation as an outcome variable that could be determined by any of the prior variables.

C. Testing the Models

Once we developed a reasonable model, we tested it on Carpenters and Machinists separately. There were too few Auto Mechanics to include in the analysis as a separate group. In addition to testing a model separately for each trade area, we recombined the data and tested it for each curriculum area--academic, vocational, and general. If there had been a large enough sample, we would have tested it for each of the three trade areas and three curricula--that is for each of nine groups.

The procedure for testing a model consists first of normalizing the scores for each questionnaire scale used. The COFAMM program uses a maximum likelihood factor analysis that assumes that all variables are normally distributed. We intentionally designed the scales to measure normally distributed variables, but in some instances, this was impossible. Number of dependents, for example, is a triangular distribution with most people having none. Most other important scales were close to normal, however, and showed only some skewedness.

After normalizing the input variables, we obtain correlation matrices for each group to be analyzed; these are the data used by the COFAMM program. The program produces a solution to the hypothesized model and performs a chi-square goodness-of-fit test. In addition to examining that chi-square value, we compute the average (RMS) value of the standardized residuals between the theoretical and empirical solutions. If that value is small (about .05 or less), we accept the model as a good fit to the data.

We found when we tested each model that many of the input variables did not fit. In other words, they either correlated only slightly with all the other variables, or they were unrelated to any of them. Sometimes, with considerable effort, we can find an appropriate place for such variables in a model. More often, however, they are either irrelevant to the causal process, or they have not been measured well enough to be useful. We found that the models for Carpenters and Machinists differed somewhat, and we will therefore present them separately.

D. The Model for Machinists

We found 18 of the 29 variables to fit in the machinists' model (see Table VII.1). Appendix E.1 shows the intercorrelations of those 18 input variables. The solution to the model is shown pictorially in Figure VII.1. Circles represent factors, and boxes represent directly measured variables. Factors have been determined by two or more variables that we hypothesized to be measuring the same thing. They are corrected for measurement error and may be regarded as "true" scores. Those variables shown in rectangles have no correction for measurement error and are assumed to be perfectly reliable. While we would prefer to have multiple measures of every variable, we will generally not exclude a variable on those grounds alone. It may still be a valuable predictor even if its correlations are attenuated.

Table VII.1

The 18 Variables Appearing in the Model for Machinists

Variable	Questionnaire Item	Name of Variable
1	S	Age
2	U-1	Dependents at application
3	U-2	Dependents now
4	B-2	Mother's education
5	B-3	Father's education
6	P-1	Father's occupation
7	C-1	English grades
8	D-1	Reading ability
9	C-3	Apprenticeship grades
10	D-2	Math computation
11	K-1	Sources of useful information (H.S.)
12	F-1	Hobbies in high school
13	G-1	Clubs in high school
14	H-1	Work experience in high school
15	N	Program rating 1
16	O	Program rating 2
17	M-1	Self-rating in job
18	M-2	Expected boss' rating

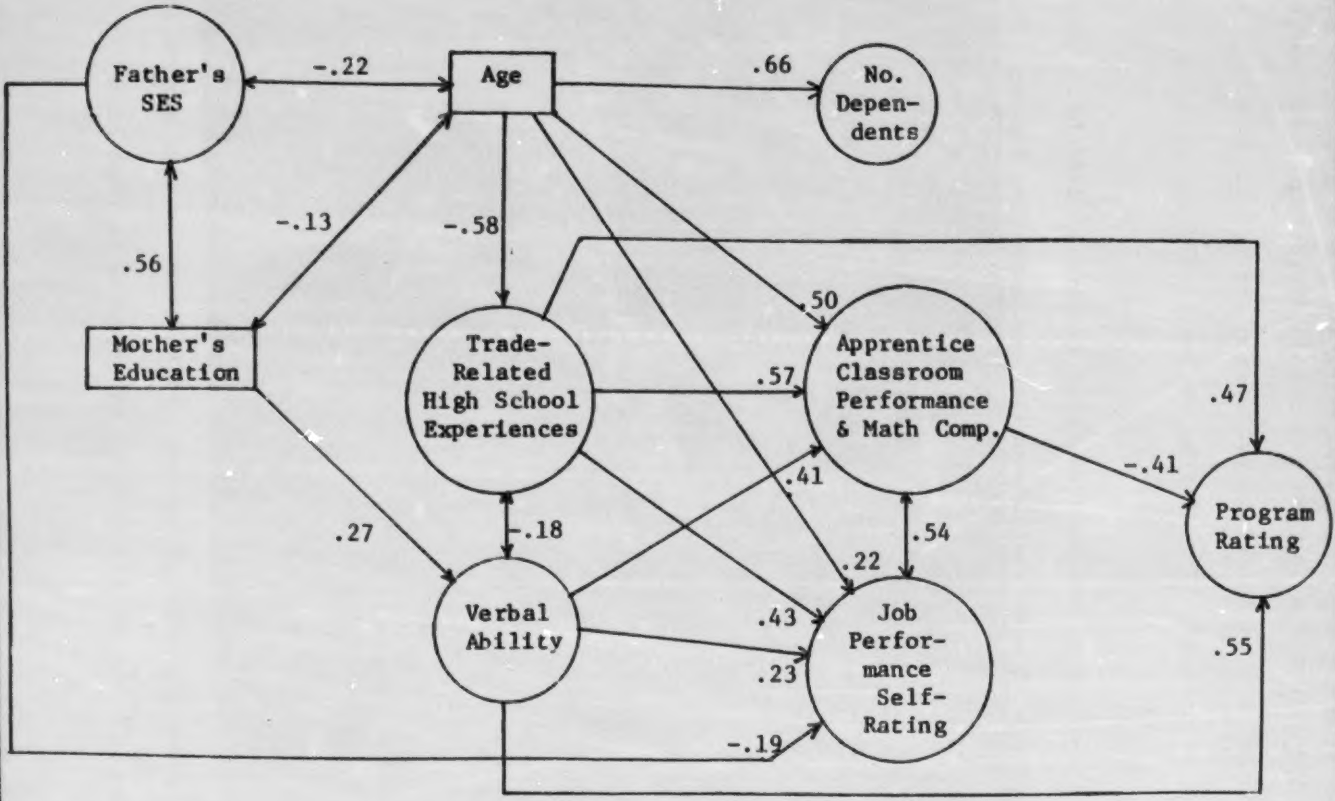

Figure VII.1

Path Analysis for Machinists

Double-pointed arrows indicate a correlation without any implication of causation. Numbers adjacent to those arrows are correlations between the factors. Directional arrows indicate the direction of causation. Numbers adjacent to the directional arrows are standardized regression weights--that is, they are the partial correlations between the two factors with all other predictors held constant. The diagram includes only correlations significantly greater than zero.

Let us now look at how each of these factors is defined. Table VII.2 shows the loadings of each variable on its corresponding factor. Father's SES is primarily father's education, though occupational status code contributes to this factor as anticipated. Mother's occupation did not fit well on the factor with mother's education, probably because most were classified as "housewife." The model fit better when mother's education alone was used. Age, of course, has only one measure and is assumed to be perfectly reliable. Number of dependents, since we designed it as a type of maturity or financial responsibility indicator, includes dependents at two different time periods. Verbal ability consists of English grades and estimated reading ability. Relevant high school experiences is most heavily weighted by the number of sources of useful information about trades and apprenticeships, secondarily by clubs and hobbies, and least by work experience. These all loaded on a single factor rather than separate ones for the different experiences. This means that they are all serving as indicators of the same thing. In other words, what they all have in common is general exposure to information sources and trade-related experiences. This factor is also a good indication of interest and motivation and must be interpreted in that light.

Table VII.2

Path Analysis for Machinists

Standardized Factor Loadings

	1	2	3	4	5	6	7	8	9
1	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.972	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.959	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.902	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.478	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.431	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.667	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.611	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.403	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.704	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.313	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.273	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.125	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.723	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.468	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.985
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.836

Variables:

1 - Age
2 - Dependents at application
3 - Dependents now
4 - Mother's education
5 - Father's education
6 - Father's occupation
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation
11 - Sources of useful information (H.S.)
12 - Hobbies in high school
13 - Clubs in high school
14 - Work experience in high school
15 - Program rating 1
16 - Program rating 2
17 - Self rating in job
18 - Expected boss' rating

Factors:

1 - Age
2 - Dependents
3 - Mother's education
4 - Father's SES
5 - Verbal ability
6 - Apprenticeship Performance
7 - Trade-related H.S. experiences
8 - Program Rating
9 - Self rating of job performance

We found that math grades did not fit with math computation ability. Rather, math computation ability fit with first-year grades in apprenticeship courses. This is not surprising because the coursework requires computation, and the apprentice will improve his skills from classroom work. His ability to do math in high school is therefore less relevant than his ability to do math during the apprenticeship. Math skills are also more likely to be improved during the apprenticeship than are verbal skills. Thus, we find verbal ability more related to high school English, and math computation more related to apprenticeship activities.

As expected, the two scales rating the apprenticeship program determine a single factor as do the self-rating and expected boss' rating.

Table VII.3 shows the correlations between the nine factors. They are defined at the bottom of the table. Note that these are different from the partial correlations in Figure VII.1. High school experiences, for example, are correlated .23 with job performance rating, but with other background variables held constant, that correlation rises to .43. We conclude that according to our model, trade-related experiences are the greatest determinant of job performance.

Another interesting relationship is that between age and high school experiences. The older Machinists reported having less information about trades and apprenticeships when they were in high school and to some extent spent less time at trade-related activities. If this is not because of faulty memory, it is an important finding because it shows that students are better informed today than they were in the past. Equally important is the finding that these relevant high school experiences are strong determinants of success in the apprenticeship coursework as indicated

Table VII.3

Path Analysis for Machinists

Correlations Between Factors

	1	2	3	4	5	6	7	8	9
1	1.000								
2	0.679	1.000							
3	-0.130	-0.149	1.000						
4	-0.225	-0.239	0.564	1.000					
5	-0.003	-0.113	0.254	0.120	1.000				
6	0.159	-0.011	0.278	0.066	0.310	1.000			
7	-0.596	-0.393	0.064	0.194	-0.181	0.199	1.000		
8	-0.267	-0.225	0.109	0.084	0.161	-0.037	0.450	1.000	
9	-0.006	-0.013	0.082	-0.053	0.159	0.545	0.227	0.285	1.000

Factors:

1 - Age
2 - Dependents
3 - Mother's education
4 - Father's SES
5 - Verbal ability
6 - Apprenticeship Performance
7 - Trade-related H.S. experiences
8 - Program Rating
9 - Self-rating of job performance

by the path coefficient of .57 between these two factors. All other things being equal, however, verbal ability is also a strong determinant of apprenticeship classroom performance, as is age directly.

From the correlation between factors we see only a small relationship between age and apprenticeship classroom performance (r=.16), but when we control for high school background, the partial correlation rises to .50. Thus, age and the experiences that go with age do appear to compensate for the lack of trade-related experiences in high school.

The model tells us that there is very little relationship between verbal ability and the knowledge about trades gained through high school experiences, but it also tells us that both are important determinants of success in apprenticeship classes as well as on the job. Job performance appears to be primarily determined by trade-related experiences in high school (including, of course, interest and motivation) and secondarily by verbal ability. Not surprisingly, age has a direct bearing on job performance. We expect the older apprentice to have more trade-related experience--apparently gained after high school. There is a small effect from father's SES, and it is the negative direction. The lower status father is likely to be a craftsman himself, and his teachings have a noticeable effect on his son's performance.

Note that mother's education affects verbal ability while father's does not. This finding is not uncommon because verbal learning begins very young and is primarily affected by the mother's teaching. Education of the parents is negatively correlated with age, not surprisingly, because younger respondents will have younger parents, and in, general, younger adults have more education. While some of these correlations are irrelevant to our primary interests, they provide evidence that the model is basically sound. If we were to find peculiar correlations between age and SES or verbal ability, for instance, we would look upon the rest of the model with skepticism.

Determinants of program ratings are typically complex. In our model there are three strong predictors of program rating. Those who were exposed to the greatest amount of information about trades in high school and who spent large amounts of time on trade-related activities rated the apprenticeship program most favorably. Most likely, this relationship is an indicator of interest in the trade. From the factor loadings in Table VII.2 we saw that item N had the greater influence in the factor called Program Rating. That item asked for satisfaction with pay, working conditions, and employer attitude rather than questions directly dealing with the quality of the program (item O). Since item O loaded on the same factor, we see statistically that there is no real separation between liking the program (being satisfied with pay, and so forth) and evaluating the quality of the program (for example, judging difficulty and relevance of apprenticeship tasks). Both are highly predictable from high school experiences and apparent interest.

If we could hold high school experiences and interests constant, as well as performance in the apprenticeship, we would find that the more verbal students rate the program higher. This is possibly also a motivation indicator, perhaps indicating degree of involvement in learning. With interests, experience, and verbal ability held constant, those with better apprenticeship grades tend to rate the program lower. This, too, is consistent with many research findings that show that those who perform the best are more critical and tend to down-rate a course. Those who do exceptionally well may feel underpaid, for example, and express their discontent in the program rating, or those who do well find the coursework too easy and are therefore critical.

Table VII.3 shows that there is a correlation of .285 between job performance and program rating. We find, however, that the correlation is explained entirely by its intercorrelation with other variables. In other words, it has no direct effect on program rating once other variables are held constant. Note that apprenticeship course performance is positively correlated with job performance. We made no assumption about causation in this relationship because the apprenticeship classes and the job are concurrent.

E. Testing the Model for Carpenters

Because the model for Machinists fit the data so well and was reasonably interpretable, we tested the same one on Carpenters, expecting the same measurement model to fit (that is, we expected the factors to be the same) but the relationships between them to be somewhat different. We found, however, that the entire model was different for Carpenters. Table VII.4 shows the variables that appear in the Carpenters' model. Their intercorrelations are in Appendix E.2. Some of the same factors were formed, but a number of the variables combined in different ways. The model which fit best appears in Figure VII.2. The four variables that formed trade-related high school experiences for machinists do not intercorrelate well for carpenters--that is, they appear to be measuring different things for the two groups. While participation in clubs is correlated with hobbies, the relationship is not so high for carpenters as it is for machinists. Thus, clubs and hobbies formed different factors, each using the two questions included to assess participation in clubs and hobbies. Relevant work experience was an important variable for Carpenters, while any type of work experience was important for Machinists. Prior work experience (item E) fit into the model as another

Table VII.4

The 20 Variables Used in the Model for Carpenters

Variable	Questionnaire Item	Variable Name
1	P-1	Father's occupation
2	B-2	Mother's education
3	B-3	Father's education
4	U-1	Dependents at application
5	U-2	Dependents now
6	S	Age
7	C-1	English grades
8	D-1	Reading ability
9	C-3	Apprenticeship grades
10	D-2	Math computation ability
11	G-1	Clubs associated with high school
12	G-2	Clubs outside of high school
13	F-1	Hobbies in high school
14	F-2	Hobbies after high school
15	I	Relevant work experience
16	E	Prior occupational training
17	N	Program Rating 1
18	O	Program Rating 2
19	M-1	Self-rating of job performance
20	M-2	Expected boss' rating

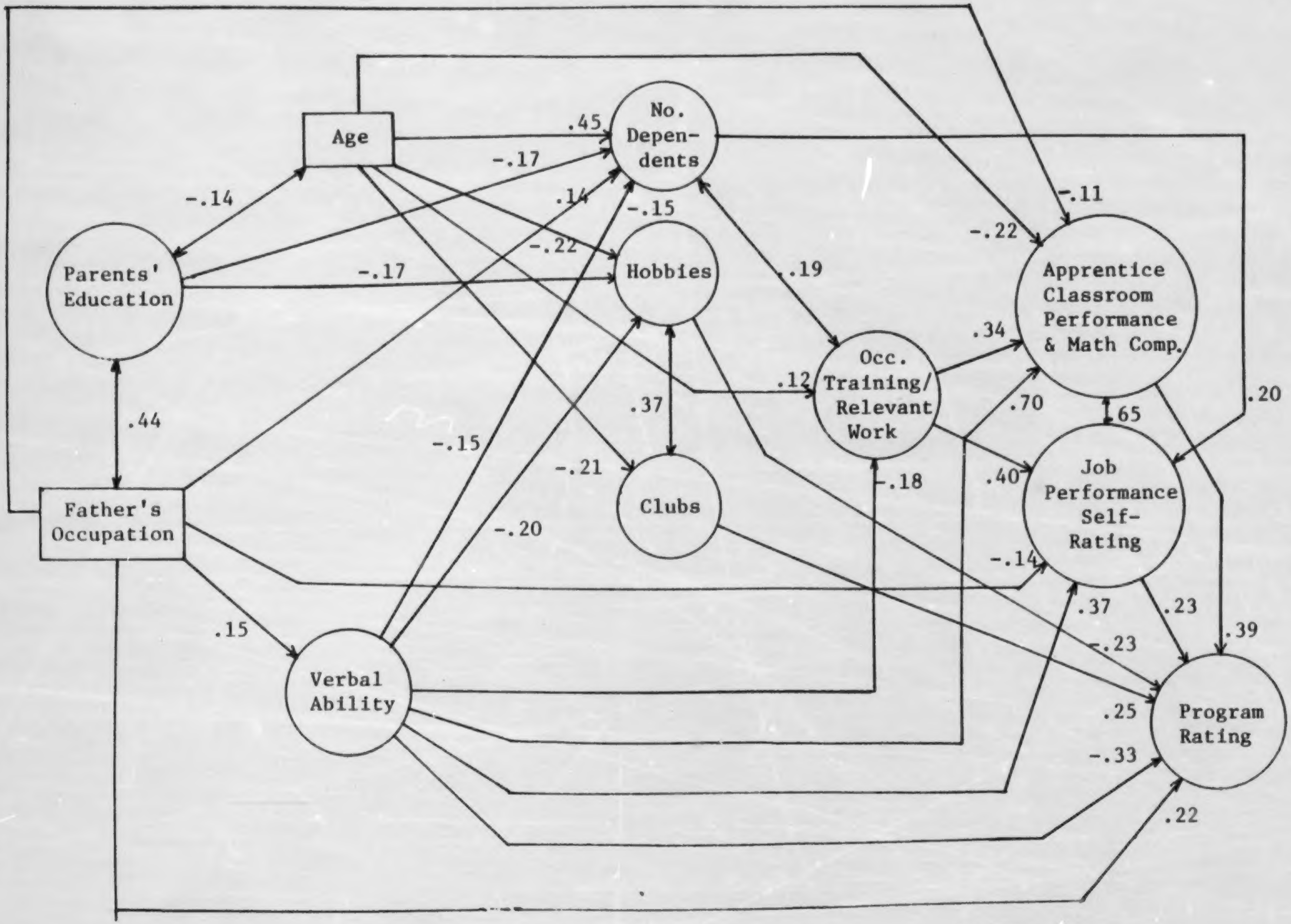

Figure VII.2

Path Analysis for Carpenters

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indicator of the same experience factor as relevant work experience. The SES variables also recombined somewhat differently for Carpenters, perhaps because of the difficulty with coding "housewife" in terms of occupational status. Parent's education formed a single factor because the educational levels of the parents were highly correlated.

While all of these differences are dramatic, particularly the activities prior to the apprenticeship, the factors for verbal ability, apprenticeship classroom performance, program rating, and job self-rating were formed from the same variables as they were for Machinists. It appears, therefore, that the important high school experiences that we use to predict apprenticeship performance are different in nature and in their interrelationships for the two apprentice groups. This finding makes comparisons between the two groups difficult.

Table VII.5 shows the factor loadings defining each of the factors. The twelfth factor was introduced to explain correlated measurement error between four of the variables. What this factor probably represents is a tendency to halo self-reports; we do not need to interpret it in our causal model. Table VII.6 shows the correlations between the factors.

One of the reasons Figure VII.2 appears so confusing is that nearly all of the factors affect nearly all of the subsequent ones, both directly and indirectly. By looking at it one factor at a time, we can explain the causal processes fairly clearly. Self-evaluation of job performance is determined about equally by verbal ability and prior occupational training and work experience. Number of dependents (not age) has some effect on job performance, perhaps indicating maturity. Father's occupation has the same small effect that we saw with Machinists.

Table VII.5

Path Analysis for Carpenters

Standardized Factor Loadings

	1	2	3	4	5	6	7	8	9	10	11	12
1	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.530	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.846	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.909	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.936	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.608	0.0	0.0	0.0	0.0	0.0	0.0	-0.213
8	0.0	0.0	0.0	0.0	0.733	0.0	0.0	0.0	0.0	0.0	0.0	0.241
9	0.0	0.0	0.0	0.0	0.0	0.432	0.0	0.0	0.0	0.0	0.0	-0.354
10	0.0	0.0	0.0	0.0	0.0	0.533	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.862	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.453	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.847	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.810	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.650	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.423	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.415	0.0	0.547
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.557	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.940	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.903	0.0

Variables:

1 - Father's occupation
2 - Mother's education
3 - Father's education
4 - Dependents at application
5 - Dependents now
6 - Age
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation ability
11 - Clubs associated with high school
12 - Clubs outside of high school
13 - Hobbies in high school
14 - Hobbies after high school
15 - Relevant work experience
16 - Prior occupational training
17 - Program Rating 1
18 - Program Rating 2
19 - Self rating of job performance
20 - Expected boss' rating

Factors:

1 - Father's occupation
2 - Parents' education
3 - Dependents
4 - Age
5 - Verbal ability
6 - App. course performance
7 - Clubs
8 - Hobbies
9 - Relevant training and experience
10 - Program rating
11 - Self-rating
12 - "Halo"

Table VII.6

Path Analysis for Carpenters

Correlations between Factors

	1	2	3	4	5	6	7	8	9	10	11	12
1	1.000											
2	0.439	1.000										
3	0.042	-0.198	1.000									
4	0.048	-0.136	0.481	1.000								
5	0.167	0.082	-0.103	0.113	1.000							
6	-0.092	-0.094	0.081	-0.072	0.603	1.000						
7	-0.021	0.030	-0.070	-0.218	-0.115	-0.088	1.000					
8	-0.140	-0.163	-0.017	-0.222	-0.246	0.016	0.369	1.000				
9	-0.175	-0.169	0.193	0.108	-0.195	0.173	0.135	0.559	1.000			
10	0.073	-0.036	0.062	0.014	0.035	0.300	0.152	-0.033	0.128	1.000		
11	-0.103	-0.030	0.171	0.079	0.258	0.651	-0.016	0.117	0.347	0.357	1.000	
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000

Factors:

1 - Father's occupation
2 - Parents' education
3 - Dependents
4 - Age
5 - Verbal ability
6 - App. course performance
7 - Clubs
8 - Hobbies
9 - Relevant training and experience
10 - Program rating
11 - Self-rating
12 - "Halo"

Job performance and apprenticeship coursework are highly correlated for Carpenters as they were for Machinists. The greatest determinant of apprentice classroom performance is verbal ability. The effect of verbal ability appears to be even higher for Carpenters than for Machinists. Occupational training and relevant work experience are also important determinants of classroom achievement. This factor appears to be the important experiential determinant of apprenticeship success for Carpenters, whereas high school experiences (sources of information, hobbies, clubs, and so forth) were the important determinants for Machinists.

In addition, with other variables held constant, the younger Carpenter appears to do somewhat better in apprenticeship coursework. This finding is different from the finding for Machinists, probably because the high school experiences are different. Remembering that older Machinists had fewer trade-related high school experiences, we concluded that the positive relationship with age could be explained in terms of life experiences between high school and the apprenticeship. With Carpenters, we find that while older apprentices spent less time in trade-related clubs and hobbies, the tendency was not as pronounced as it was among Machinists. Furthermore, participation in clubs and hobbies is unrelated to performance in the apprenticeship for Carpenters and quite related for Machinists. What these patterns suggest is that for Carpenters, the best preparation for the apprenticeship is basic reading and writing skills possibly supplemented by relevant work experience or occupational training. It is likely that the negative partial correlation with age simply says that someone who is recently out of school will do better at classroom work than someone who has been away from the classroom for some years. We did not find this to be the case for Machinists, even though verbal ability did play an important role in classroom performance.

Program rating again has many determinants, and the patterns are different than they were for Machinists. Apprenticeship classroom work appears to have the greatest positive effect on program rating. This is the opposite of the finding for Machinists. But notice from the table of factor loadings that the program rating factor for Carpenters is determined more heavily by questionnaire item O which rates aspects of the program. For Carpenters, this factor may be a more accurate indication of program quality than it is for Machinists, who appeared to rate the program highly if they liked the pay and working conditions and were highly motivated. Some of the other path coefficients are reversed from what they were for Machinists. With apprenticeship course performance and other variables held constant, verbal ability predicts program rating negatively. What this says is that of all the apprentices getting the same grades in their cousework, the more verbal ones rate the program lower--they are more critical. It may be that the more verbal apprentices had higher expectations of the program, perhaps because their academic abilities were high.

Some of the other interrelationships are worth noting. Remember that for Machinists, the number of dependents was determined entirely by the apprentice's age. Interestingly, among Carpenters, the number of dependents is affected by other variables as well. Appprentices whose parents have more education, whose fathers have lower status jobs, and who themselves have higher verbal ability appear to have fewer children. As in the Machinist analysis, older apprentices also have parents with somewhat less education. All of these relationships are consistent with census findings and the results of many research studies.

In addition, those whose fathers have higher status jobs (white collar occupations) have higher verbal ability. Carpenters who have trade-related hobbies tend to have lower verbal ability and parents with less education. Those who have had prior occupational training and relevant work experiences also tend to have lower verbal skills.

F. Analysis by High School Curriculum

We recombined the data from all three trade areas and regrouped it by high school curriculum. Then, because the model for Machinists was clearer and more easily interpreted than the one for Carpenters, we tested it separately for those who had been in academic, vocational, and general curricula. Intercorrelations of input variables are shown in Appendix E.3-E.5. We found the model to fit the data very well for each of these groups, but with the factors interrelated in different ways. Factors loadings appear in Table VII.7 to VII.9, and correlations between factors are in Tables VII.10 to VII.12.

The solution for the academics appears in Figure VII.3. Apprentices having fathers with higher occupational status tend to have fewer children. Likewise, those with higher verbal ability have mothers with more education and tend to have fewer children. With mother's education held constant, the high verbal apprentice has a lower SES father.

As in the model for Machinists, older apprentices tend to have had fewer trade-related high school experiences. Interest in the trades and participation in trade-related activities is negatively related to verbal ability, but both have a positive effect on apprenticeship course performance. Verbal ability is the primary determinant of success in first-year apprenticeship classes. Self-rating of job performance depends on high school experiences (sources of relevant information about trades; motivation) and on verbal ability. We saw earlier that the academic student has higher verbal

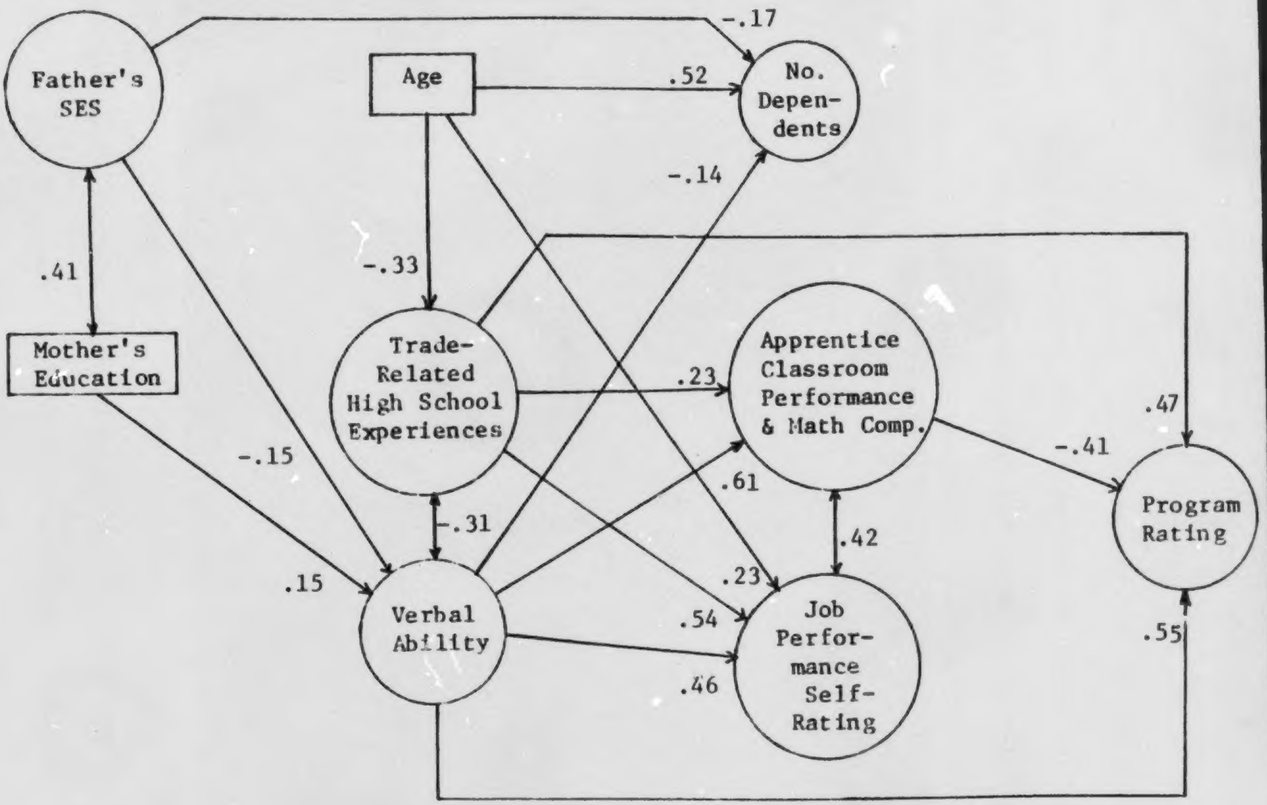

Figure VII.3

Path Analysis for Academic Curriculum Graduates ability, on the average, than students in vocational or general programs. This ability appears to have a strong bearing on job performance as well as being a determinant of success in the apprenticeship coursework. We see also that when other predictors are held constant, the older apprentice appears to perform better on the job, probably because of trade-related life experiences.

The determinants of program rating are very similar to those we found for Machinists. With other variables held constant, such as apprenticeship classroom performance, high school experiences and verbal ability are each strong positive determinants of program rating. When they are held constant, apprenticeship performance has a reverse effect. In other words, apprentices with equal backgrounds who do well in their apprenticeship classes will rate it lower than those who did less well in it, probably indicating that it was too easy or they felt they were insufficiently rewarded (underpaid, for example). For those who performed equally well in the apprenticeship coursework, the more academically able, highly motivated, and better prepared students rated the program most highly. As with Machinists, program rating does not seem to reflect job performance.

Figure VII.4 shows the model for those who completed a vocational high school curriculum. While the measurement model was the same as that for academics, the interrelationships between factors were quite different. Age and parents' SES indicators are negatively related, as in the machinists' model, suggesting that older apprentices have parents with less education. Number of dependents is affected only by age, and apparently not by social factors. Older apprentices had fewer sources of relevant trade information in high school and participated less in trade-related activities. Those of lower verbal ability tended to spend more time and have more interest in trade-related activities.

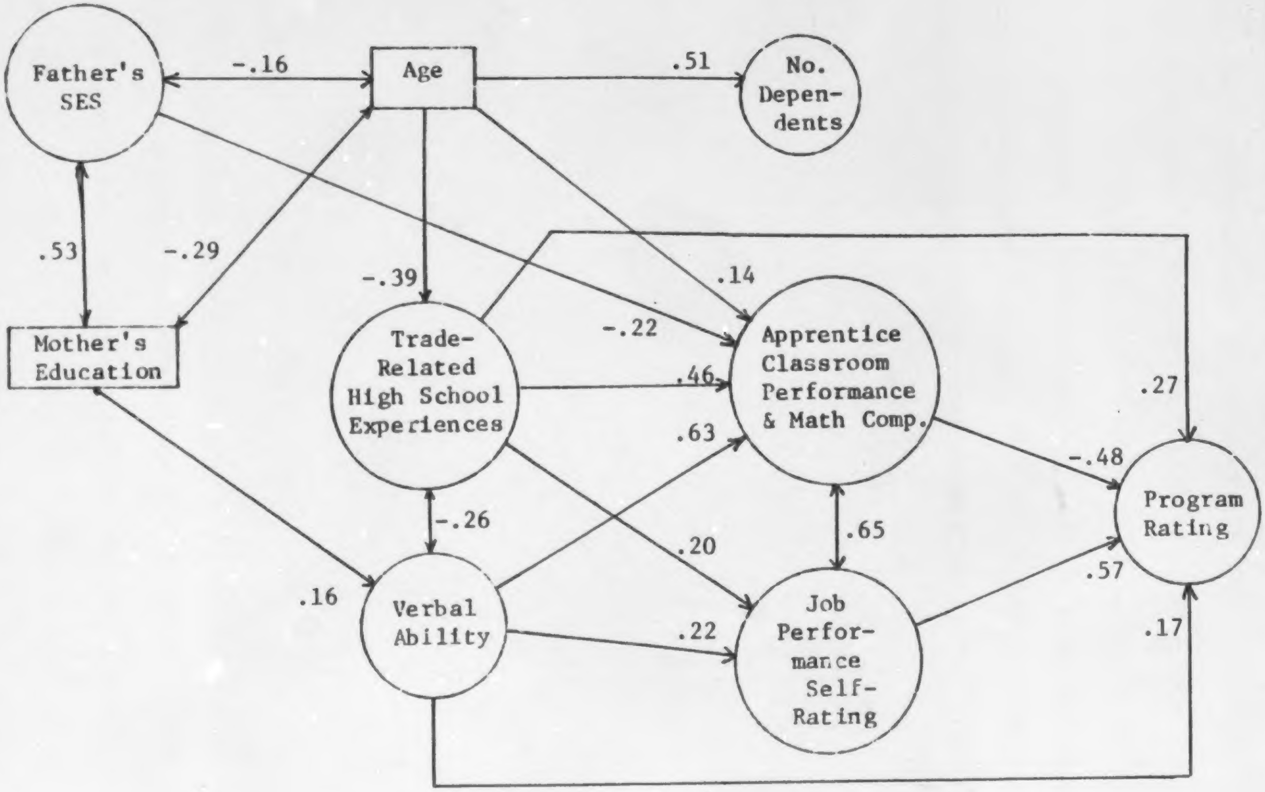

Figure VII.4

Path Analysis for Vocational Curriculum Graduates

In contrast with the academic graduate's model, trade-related high school experiences have a stronger effect on performance in apprenticeship classes. This suggests that motivation, interest in trades, time spent doing trade-related hobbies, jobs, and talking with people about trades while in high school are important determinants of success in apprenticeship classes for vocational students. While these things are important for academics, they are not as important as they are for vocational students.

Verbal ability is still the most important determinant of success in apprenticeship courses. Reading and writing skills are just as important for the vocational student as they are for the academic.

Age has a small but real effect on apprenticeship performance when all other background variables are held constant. This is likely to be because the older apprentice has learned through life experiences some of what the younger one has learned more recently in high school and is likely to be more motivated. Father's SES has a direct bearing on apprenticeship performance, suggesting that the lower status father (one who is a craftsman) teaches his son skills that are directly applicable to the apprenticeship course.

Self-rating of job performance is more highly correlated with classroom achievement for vocational graduates than it is for academics. It is also less determined by verbal ability or high school trade-related experiences and interests. In fact, job performance is less predictable for vocational graduates than for academic graduates, perhaps because we did not measure the most important determinants of job performance for this group. Content of coursework, for example, was not studied, and it may have a measurable effect on job performance. In the absence of further information, we can only conclude that apprenticeship classroom performance is well-predicted in our model, but job performance is not.

Program rating, strangely enough, is strongly affected by job performance with those perceiving themselves as doing best on the job rating the program most highly. The negative prediction from classroom performance and positive prediction from high school experiences is consistent with the academic model.

Figure VII.5 shows the model for those in a general education curriculum. From the table of factor loadings (Table VII.9) we see that the loadings on apprenticeship course performance are quite low, and the standard errors for all correlations with that factor are very high (Appendix F.5). When it is included in the model, over-correction for attenuation results in unreasonably large regression weights with very large standard errors. The model is uninterpretable. By removing that poorly defined factor, a reasonable and well-fitting model is possible. Unfortunately, it can only predict job performance and program rating. Number of dependents is determined solely by age. Older apprentices have parents with somewhat less education. Those with low verbal ability tend to participate more in trade-related high school activities. Older apprentices had fewer trade-related high school experiences. Program rating is positively affected by high school experiences, verbal ability, and job performance. Those with the best verbal ability and who learned most about trades while in high school rated themselves highest in job performance. The older apprentices also appear to have gained job-related skills that improved their performance.

One reason why this model was difficult to fit may have been that there were only about 120 apprentices in the general curriculum for whom we had complete questionnaire data. In a larger sample, we might have found more stability in the model estimates. In addition, prior research has consistently

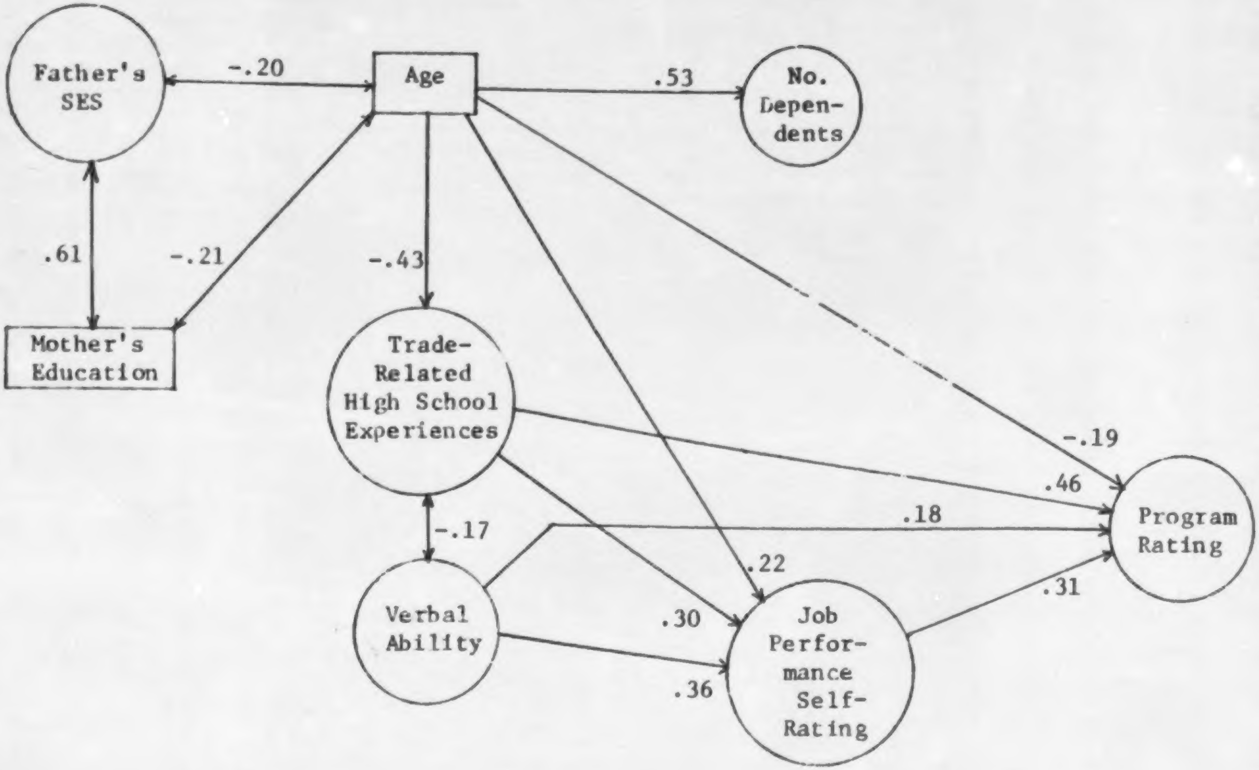

Figure VII.5

Path Analysis for General Curriculum Graduates shown difficulties in studying students in a general curriculum. Typically, academic students score higher on tests and achieve higher grades than vocational or general students. Compared with general students, vocational students achieve higher grades, are less alienated toward school, and focus more on occupational aspirations (Echternacht, 1976). General curriculum students are often underachievers whose parents encourage them to pursue a college education, but because the students are either unmotivated or academically unable, they are not in an academic program. Thus, the sample is likely to consist of a variety of types of people for whom patterns of achievement are difficult to assess.

G. Summary of Major Path Analysis Findings

While the analysis itself was quite complex, we can draw a number of general conclusions regarding similarities and differences among apprentices across different trade areas and high school backgrounds.

1. Older apprentices had fewer trade-related experiences in high school, including exposure to useful sources of information about trades and involvement in clubs and hobbies.
2. Regardless of trade area or high school curriculum, verbal ability is a primary determinant (possibly the most important determinant) of achievement in first-year apprenticeship coursework and in job performance.
3. Verbal ability is a more important determinant of job performance for academic students than vocational students. It has an equally important effect on classroom performance for both groups.
4. Trade-related high school experiences and exposure to information about trades and apprenticeships are important determinants of apprenticeship achievement, both in coursework and on the job.

5. Trade-related high school experiences affect apprenticeship classroom performance more for vocational students than for academic ones.
6. Performance in the classroom and on the job are strongly related for all groups.
7. Job performance is more predictable from the variables we studied for academic graduates than it is for vocational graduates. Other variables, which we did not measure, could account for most of the prediction of job performance. Because we did not study the content of the high school vocational program and we did not have grades in vocational courses, we could not include those in the prediction. We might speculate that these have a significiant effect on job performance and suggest that they be included in future studies.

Table VII.7

Path Analysis for Academic Curriculum Graduates

Standardized Factor Loadings

	1	2	3	4	5	6	7	8	9
1	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.967	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.886	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	1.058	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.474	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.522	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.701	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.490	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.596	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.375	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.449	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.217	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.322	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.040	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.437	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.906
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.986

Variables:

1 - Age
2 - Dependents at application
3 - Dependents now
4 - Mother's education
5 - Father's education
6 - Father's occupation
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation
11 - Sources of useful information (H.S.)
12 - Hobbies in high school
13 - Clubs in high school
14 - Work experience in high school
15 - Program rating 1
16 - Program rating 2
17 - Self-rating in job
18 - Expected boss' rating

Factors:

1 - Age
2 - Dependents
3 - Mother's education
4 - Father's SES
5 - Verbal ability
6 - Apprenticeship Performance
7 - Trade-related H.S. experiences
8 - Program Rating
9 - Self-rating of job performance

Table VII.8

Path Analysis for Vocational Curriculum Graduates

Standardized Factor Loadings

	1	2	3	4	5	6	7	8	9
1	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.931	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.972	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.816	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.310	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.526	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.464	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.563	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.505	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.599	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.345	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.386	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.354	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.660	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.450	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.960
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.837

Variables:

1 - Age
2 - Dependents at application
3 - Dependents now
4 - Mother's education
5 - Father's education
6 - Father's occupation
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation
11 - Sources of useful information (H.S.)
12 - Hobbies in high school
13 - Clubs in high school
14 - Work experience in high school
15 - Program rating 1
16 - Program rating 2
17 - Self-rating in job
18 - Expected boss' rating

Factors:

1 - Age
2 - Dependents
3 - Mother's education
4 - Father's SES
5 - Verbal ability
6 - Apprenticeship Performance
7 - Trade-related H.S. experiences
8 - Program Rating
9 - Self-rating of job performance

Table VII.9

Path Analysis for General Curriculum Graduates

Standardized Factor Loadings

	1	2	3	4	5	6	7	8	9
1	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.852	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	1.057	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.875	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.545	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.511	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.786	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.168	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.496	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.600	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.506	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.357	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.116	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.619	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.292	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.887
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.900

Variables:

1 - Age
2 - Dependents at application
3 - Dependents now
4 - Mother's education
5 - Father's education
6 - Father's occupation
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation
11 - Sources of useful information (H.S.)
12 - Hobbies in high school
13 - Clubs in high school
14 - Work experience in high school
15 - Program rating 1
16 - Program rating 2
17 - Self-rating in job
18 - Expected boss' rating

Factors:

1 - Age
2 - Dependents
3 - Mother's education
4 - Father's SES
5 - Verbal ability
6 - Apprenticeship Performance
7 - Trade-related H.S. experiences
8 - Program Rating
9 - Self-rating of job performance

Table VII.10

Path Analysis for Academic Curriculum Graduates

Correlations between Factors

	1	2	3	4	5	6	7	8	9
1	1.000								
2	0.547	1.000							
3	-0.057	-0.094	1.000						
4	-0.081	-0.196	0.413	1.000					
5	0.125	-0.027	0.082	-0.099	1.000				
6	-0.032	0.145	0.047	-0.082	0.541	1.000			
7	-0.334	-0.226	0.009	0.070	-0.312	0.048	1.000		
8	-0.012	-0.166	-0.105	-0.071	0.196	-0.086	0.277	1.000	
9	0.143	0.056	0.057	-0.054	0.327	0.421	0.299	0.191	1.000

Factors:

1 - Age
2 - Dependents
3 - Mother's education
4 - Father's SES
5 - Verbal ability
6 - Apprenticeship Performance
7 - Trade-related H.S. experiences
8 - Program Rating
9 - Self-rating of job performance

Table VII.11

Path Analysis for Vocational Curriculum Graduates

Correlations between Factors

	1	2	3	4	5	6	7	8	9
1	1.000								
2	0.559	1.000							
3	-0.159	-0.095	1.000						
4	-0.291	-0.220	0.529	1.000					
5	-0.012	-0.105	0.049	0.132	1.000				
6	-0.013	-0.075	0.058	-0.036	0.484	1.000			
7	-0.414	-0.277	0.137	0.190	-0.257	0.217	1.000		
8	-0.189	-0.100	0.234	0.268	-0.025	0.043	0.238	1.000	
9	0.022	0.082	0.093	-0.014	0.141	0.652	0.098	0.315	1.000

Factors:

1 - Age
2 - Dependents
3 - Mother's education
4 - Father's SES
5 - Verbal ability
6 - Apprenticeship Performance
7 - Trade-related H S. experiences
8 - Program Rating
9 - Self-rating of job performance

Table VII.12

Path Analysis for General Curriculum Graduates

Correlations between Factors

	1	2	3	4	5	6	7	8	9
1	1.000								
2	0.550	1.000							
3	-0.209	-0.177	1.000						
4	-0.200	-0.081	0.607	1.000					
5	-0.026	-0.115	0.206	0.158	1.000				
6	-0.217	0.177	-0.242	0.045	0.563	1.000			
7	-0.423	-0.260	0.103	0.046	-0.173	0.280	1.000		
8	-0.274	-0.064	0.151	-0.012	0.181	0.018	0.523	1.000	
9	0.098	0.123	0.037	-0.059	0.288	0.428	0.146	0.447	1.000

Factors:

1 - Age
2 - Dependents
3 - Mother's education
4 - Father's SES
5 - Verbal ability
6 - Apprenticeship Performance
7 - Trade-related H.S. experiences
8 - Program Rating
9 - Self-rating of job performance

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APPENDIX A

APPRENTICE I.D. NUMBER

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF EDUCATION
BOX 911, HARRISBURG, PA. 17126

June 8, 1981

Dear Sir/Madam:

In cooperation with the Pennsylvania Apprenticeship and Training Council and the Bureau of Apprenticeship Training, we are conducting a study of apprenticeship programs. The purpose of the study is to help people who are thinking about becoming apprentices understand what the program and the trade are like. Although you are no longer an apprentice, your opinions are very important to us as we seek to help people like yourself who in the future may wish to become apprentices. This questionnaire asks some information about yourself and about your own personal experiences with the apprentice program. It will take about ten minutes to complete.

All of your answers will be held in the strictest confidence. An independent research organization, Educational Testing Service of Princeton, New Jersey, will conduct the study. Your questionnaire will be coded. No individual names or responses will be identified or reported in this study.

Your response is very important to the success of the study. Please use the enclosed, postage-paid envelope to return the questionnaire within one week.

Thank you for your time and effort.

Sincerely,

Dr. Carroll Curtis, Director
Research Coordinating Unit for
Vocational Education

Mr. James Baker, Director
Pennsylvania Apprenticeship and
Training Council

Mr. Paul Smith, Director
Bureau of Apprenticeship and
Training

A. WHILE IN HIGH SCHOOL WHICH BEST DESCRIBES THE PROGRAM IN WHICH YOU WERE ENROLLED? (Circle one number)

Academic/college preparatory	1
Vocational or business education	2
General education	3

B. WHAT WAS THE HIGHEST LEVEL OF EDUCATION COMPLETED? PLEASE ANSWER FOR YOURSELF AND FOR EACH OF YOUR PARENTS OR GUARDIANS. (Circle one number in each column)

	Self	Mother	Father
Less than 4 years of high school	1	1	1
High school diploma or equivalent	2	2	2
Some Business or Trade School after high school	3	3	3
Some college or community college	4	4	4
Completion of a trade/skill certificate program or a 2-year degree	5	5	5
Completion of a 4-year college degree or beyond	6	6	6

C. WHAT BEST DESCRIBES THE AVERAGE GRADE YOU RECEIVED IN EACH OF THE FOLLOWING AREAS: (Circle one number in each column)

	English in High School	Math in High School	Apprentice Classroom Courses
Mostly A (90-100)	1	1	1
About Half A and Half B (85-89)	2	2	2
Mostly B (80-84)	3	3	3
About Half B and Half C (75-79)	4	4	4
Mostly C (70-74)	5	5	5
About Half C and Half D (65-69)	6	6	6
Mostly D (60-64)	7	7	7
Mostly Below D (below 60)	8	8	8

D. HOW WOULD YOU RATE YOUR ABILITY IN EACH OF THE FOLLOWING AREAS? (Circle one number in each column)

	Reading Ability	Math Computation
Excellent	1	1
Above Average	2	2
Average	3	3
Fair	4	4
Poor	5	5

NOTE: The answers to the survey will be kept strictly confidential and will be used for research only.

E. DID YOU RECEIVE ANY OCCUPATIONAL TRAINING PRIOR TO YOUR APPRENTICE PROGRAM? (Circle one number)

No	1	
Yes	2	If yes, where did you receive your prior training? (Circle all numbers that apply)

Vocational education program - high school	1
CETA	2
Military	3
Business school or technical institute	4
Community/Junior Colleges	5
Four year institution	6
Pre-Apprenticeship Training Program	7
Other____________________	8

F. HOW MANY HOURS PER WEEK HAVE YOU SPENT AT HOBBIES RELATED TO YOUR TRADE? If none, please write a zero in each box.

During High School ☐ After High School Graduation ☐

G. HOW MANY YEARS OF EXPERIENCE HAVE YOU HAD AS A MEMBER OF CLUB(S) RELATED TO YOUR TRADE? (Circle one number in each column)

	High School Clubs	Clubs-Not Sponsored by High School
None	1	1
Less than 1 year	2	2
At least 1 year but less than 2 years	3	3
At least 2 years but less than 3 years	4	4
Three years or more	5	5

H. HOW MANY YEARS OF WORK EXPERIENCE OF ANY KIND HAVE YOU HAD? (Circle one number in each column)

	During High School	After High School Graduation
None	1	1
Less than 1 year	2	2
At least 1 year but less than 2 years	3	3
At least 2 years but less than 3 years	4	4
Three years or more	5	5

NOTE: The answers to the survey will be kept strictly confidential and will be used for research only.

I. HOW MANY YEARS OF PRIOR WORK EXPERIENCE DID YOU HAVE WHICH USED THE SAME OR SIMILAR SKILLS AND KNOWLEDGE WHICH YOU NEED FOR YOUR APPRENTICE TRADE? (Circle one number)

None	1
Less than 1 year	2
At least 1 year but less than 2 years	3
At least 2 years but less than 3 years	4
Three years or more	5

J. AT THE TIME YOU MADE APPLICATION TO THE APPRENTICE PROGRAM, DID YOU HAVE RELATIVES OR FRIENDS IN YOUR APPRENTICE PROGRAM? (Circle one number)

No	1
Yes	2

If yes, who was in your apprentice trade area?
(Circle all numbers that apply)

Parent	1
Other relative	2
Friend	3

K. WHICH OF THE FOLLOWING SOURCES GAVE YOU USEFUL INFORMATION ABOUT TRADES AND/OR THE APPRENTICE PROGRAM? (Circle all numbers that apply in each column)

	During High School	After High School Graduation
Parent/Guardian	1	1
Other relative or friend	2	2
Counselor	3	3
Union notices, brochures, representative	4	4
Company notices, brochures, representative	5	5
Vocational education teacher	6	6
Other teachers	7	7
State or federal apprenticeship agencies	8	8
Community-based organizations (such as Urban League, OIC, RTP, SER)	9	9
None of the above	10	10

NOTE: The answers to the survey will be kept strictly confidential and will be used for research only.

L. HOW MUCH ACCURATE INFORMATION WERE YOU ABLE TO FIND OUT ABOUT YOUR TRADE BEFORE YOU STARTED YOUR APPRENTICESHIP? (Circle one number in each row)

	A Great Deal of Accurate Information	Some Accurate Information	Very Little Accurate Information
Nature of the work	1	2	3
Working conditions	1	2	3
Rate of pay	1	2	3
Job Opportunities	1	2	3
Steadiness of work in trade	1	2	3
Opportunities for promotion	1	2	3
Apprenticeship duties and responsibilities	1	2	3
Appenticeship working conditions	1	2	3

M. HOW WOULD YOU RATE YOURSELF AND HOW WOULD YOUR BOSS RATE YOU IN EACH OF THE FOLLOWING AREAS? (Circle one number for your rating and one number for your boss' rating in each row.)

	How would you rate yourself?			How would your boss rate you?		
	Above Average	Average	Fair	Above Average	Average	Fair
Ability to use tools and equipment	1	2	3	1	2	3
Knowledge of job duties	1	2	3	1	2	3
Knowledge of technical information	1	2	3	1	2	3
Accuracy and quality of work	1	2	3	1	2	3
Use of safe work practices	1	2	3	1	2	3
Attendance	1	2	3	1	2	3
Getting along with fellow workers	1	2	3	1	2	3
Getting along with supervisors	1	2	3	1	2	3
Completing assignments on time	1	2	3	1	2	3
Amount of supervision needed	1	2	3	1	2	3
Adapting to new situations	1	2	3	1	2	3
Performance in classroom instruction	1	2	3	1	2	3

NOTE: The answers to the survey will be kept strictly confidential and will be used for research only.

N. IN GENERAL, HOW WOULD YOU RATE THE APPRENTICE PROGRAM IN THE FOLLOWING AREAS: (Circle one number in each row)

	Excellent	Above Average	Average	Fair	Poor
Pay	1	2	3	4	5
Working conditions	1	2	3	4	5
Employers attitude	1	2	3	4	5

O. THINKING BACK OVER ALL THE TIME YOU HAVE SPENT AS AN APPRENTICE, HOW WOULD YOU RATE EACH OF THESE EXPERIENCES? (Circle one number in each row)

	Never	Sometimes	Half The Time	Usually	Always
The work assignments helped me to learn the trade	1	2	3	4	5
The jobs given to me were too easy	1	2	3	4	5
I was able to ask questions and get help from my supervisor	1	2	3	4	5
The time allowed to learn each job was too short	1	2	3	4	5
I knew how well I was doing on the job	1	2	3	4	5
The jobs given to me were too hard	1	2	3	4	5
My classroom instruction was useful on the job	1	2	3	4	5
Classroom courses were too hard	1	2	3	4	5
The tools, equipment, and materials in the classroom were similar to those on the job	1	2	3	4	5
Classroom courses were too easy	1	2	3	4	5
The teacher explained things well	1	2	3	4	5
Books used in the courses were too hard to understand	1	2	3	4	5

NOTE: The answer to the survey will be kept strictly confidential and will be used for research only.

P. SELECT THE KIND OF OCCUPATION WHICH BEST DESCRIBES THE KIND OF WORK EACH OF YOUR PARENTS OR GUARDIAN DOES. IF EITHER OF YOUR PARENTS IS CURRENTLY NOT WORKING OR DECEASED MARK THE KIND OF WORK HE OR SHE USED TO DO. (Circle one number in each column)

	Father	Mother
CLERICAL such as bank teller, bookkeeper, secretary, typist, mail carrier, ticket agent	1	1
CRAFTSMAN such as baker, automobile mechanic, machinist, painter, plumber, telephone installer, carpenter, iron worker, cement mason, electrician, welder	2	2
FARMER, FARM MANAGER	3	3
HOMEMAKER OR HOUSEWIFE	4	4
LABORER such as construction worker, car washer, sanitary worker, farm laborer, janitor private household worker	5	5
MANAGER, ADMINISTRATOR such as sales manager, office manager, school administrator, buyer, restaurant manager, government official	6	6
OPERATOR such as assembler, machine operator, taxicab, bus, or truck driver	7	7
PROFESSIONAL such as accountant, artist, clergyman, dentist, physician, registered nurse, engineer, lawyer, librarian, teacher, writer, scientist, social worker, actor, actress	8	8
PROPRIETOR OR OWNER such as owner of a small business, contractor, restaurant owner	9	9
PROTECTIVE SERVICE such as detective, policemen or guard, sheriff, fireman	10	10
SALES such as salesman, sales clerk, advertising or insurance agent, real estate broker	11	11
SERVICE such as barber, beautician, practial nurse, waiter	12	12
TECHNICAL such as draftsperson, medical or dental technician, computer programmer	13	13

Q. SEX (Circle one number)

Female 1 Male 2

R. RACE (Circle one number)

American Indian/Alaskan Native 1 Asian/Pacific Islander 2 Hispanic 3

Black, Not Hispanic 4 White, Not Hispanic 5

S. AGE: ________

NOTE: The answers to the survey will be kept strictly confidential and will be used for research only.

T. MARITAL STATUS: (Circle one number in each column)

	At Time of Appentice Application	Now
Single	1	1
Married	2	2
Divorced/Separated	3	3
Widowed	4	4

U. NUMBER OF DEPENDENTS: (Do not count yourself):

At time of Appentice Application ________ Now ________

V. UNION MEMBERSHIP: (Circle one number in each row)

	Yes	No
Were you a union member at the time you applied to the apprentice program?	1	2
Are you currently a union member	1	2

W. EMPLOYEE STATUS: (Circle one number)

At the time of application to the apprentice program were you an employee of the company where you are now apprenticed?

Yes	1
No	2

X. OTHER INFORMATION: (Circle one number in each row)

	Yes	No
Are you a veteran?	1	2
Are you physically handicapped?	1	2

Y. MAY WE CALL YOU FOR A SHORT TELEPHONE INTERVIEW? (About 15 minutes) Yes No

Home Telephone Number ________-____________

Day of the week ____________ and time ________ it would be most convenient to call.

Your participation is very important, please help us to learn more about apprentice training programs.

THANK YOU FOR ALL YOUR HELP

* Please return this questionnaire in the self-addressed postage paid envelope within one week to:

Educational Testing Service
Room D-162
Princeton, NJ 08541

FOR ETS USE ONLY

SPONSORSHIP	________
CO. SIZE	________
	________
OTHER	________

APPENDIX B

Telephone Interview

We would like to know what led you to the decision to become an apprentice.

1. What were you doing at the time you applied to the apprentice program?

   a. Working ______________________

   b. Going to school ______________

   c. Unemployed ___________________

   d. Other ____

2. Why was the apprenticeship program appealing to you?

   a. Pay

   b. Job Opportunities

   c. Like the apprenticeship work better

   d. Didn't like the job I was doing

   e. Didn't like my boss

   f. Didn't like the working conditions

   g. Opportunity for training

   h. Other ______________________________

   ____

   ____

3. As you think back to high school, what about your high school experience helped you to be accepted in the apprentice program?

   ____

   ____

   ____

   a. Courses:
   Which ones ____

   ____

   ____

b. Trade Information ______________________________

____

____

c. Guidance ______________________________

____

____

d. Other ______________________________

____

____

4. What do you think the high school could do to help people to become apprentices?

____

____

____

____

____

____

5. As you think back to high school -

a. Were you encouraged to go into the trades?

(1) Yes

(2) No

If yes, by whom? (Circle ALL numbers that apply)

Parent Guardian	1
Other relative or friend	2
Counselor	3
Union representative, notices, brochures	4
Company representative, notices, brochures	5
Vocational education teacher	6
Other teachers	7
State or federal apprenticeship agencies	8

Community-based organizations (such as Urban League, OIC, RTP, SER)	9
None of the above	10

b. Were you encouraged to select one trade over another?

(1) Yes If yes, by whom ____________________

(2) No

c. Were you encouraged to go on to college?

(1) Yes If yes, by whom ____________________

(2) No

d. Were you encouraged to do anything else after high school?

(1) Yes (2) No

If yes, what were you encouraged to do?

____

By whom ______________________________

e. Other ______________________________

6. At the time you made application to the apprentice program, did you have relatives or friends in YOUR apprentice program?

(1) Yes (2) No

If yes, who was in your apprentice trade area? (Circle One Number)

Parent	1
Other relative	2
Friend	3

7. Employment Status

(1) Are you now employed?

(2) Where ______________________________

____

____

(3) May we contact your employer for follow-up information?

(1) Yes

(2) No

If the interviewee should ask what information you would be asking the employer or why, you might say.

> "In your response to our questionnaire, you rated yourself and made guesses of your bosses. We are interested in seeing if the rating is the same." The "why" is that our data show that one indication of apprentice success is their self-rating, and we want to check it out further.

APPENDIX C

MONTH	DAY	YEAR

Date Survey Completed

PENNSYLVANIA APPRENTICESHIP EMPLOYER SURVEY

Name of Apprentice

Apprentice I.D. Number

Name of Supervisor

Place of Employment

A. THE FOLLOWING TWO QUESTIONS REFER TO A PARTICULAR APPRENTICE. TRY TO BASE YOUR RESPONSES ON YOUR EXPERIENCES WITH THIS INDIVIDUAL ONLY.

1. How would you rate this particular apprentice in each of the following areas? *(Circle your ratings.)*

	Above Average	Average	Fair
Ability to use tools and equipment	1	2	3
Knowledge of job duties	1	2	3
Knowledge of technical information	1	2	3
Accuracy and quality of work	1	2	3
Use of safe work practices	1	2	3
Attendance	1	2	3
Getting along with fellow workers	1	2	3
Getting along with supervisors	1	2	3
Completing assignments on time	1	2	3
Amount of supervision needed	1	2	3
Adapting to new situations	1	2	3
Performance in classroom instruction	1	2	3

2. Please rate each of the following areas in which you feel that this particular apprentice needs improvement. *(Circle your ratings.)*

	Needs No Improvement	Needs Some Improvement	Needs A Lot of Improvement
Basic English (Reading & Writing)	1	2	3
Basic Math	1	2	3
Basic Knowledge of Trade	1	2	3
Work Attitudes	1	2	3

B. THIS SET OF QUESTIONS REFER TO APPRENTICES IN GENERAL. PLEASE BASE YOUR RESPONSES ON YOUR EXPERIENCE AS A SUPERVISOR OF APPRENTICES.

1. Which of the following is the most typical reason for the termination of employment for apprentices? *(Check only one.)*

   Fired ☐ Quit ☐ Laid Off ☐

2. Please rank each of the following from 1 to 4 as reasons for apprentices being fired. (1 = Most typical reason; 4 = Least typical reason.) If you do not know of an apprentice having been fired, check this box. ☐

   Rank

   ___ Tardiness

   ___ Absenteeism

   ___ Inadequate job performance

   ___ Improper attitude or behaviors on the job

3. Please rate each of the following as reasons apprentices give for voluntarily quitting their apprenticeships. If you do not know of an apprentice voluntarily quitting, check this box. ☐ *(Circle your ratings.)*

	Reason Often Given	Reason Occasionally Given	Reason Never Given
Felt that the pay was too low.	1	2	3
Did not see enough job opportunities in the occupation.	1	2	3
Did not like the apprenticeship work.	1	2	3
Returned to a former job.	1	2	3
Did not like his boss.	1	2	3
Did not like the working conditions.	1	2	3
Felt that he was not getting enough training.	1	2	3

4. Which, if any, of the following are problems that supervisors perceive to be serious among their apprentice employees? *(Check all that apply.)*

   ___ Domestic problems

   ___ Health problems

   ___ Trouble with the law

   ___ Child care

   ___ Language difficulties

   ___ Drinking

   ___ Drugs

   ___ Transportation

   ___ Indebtedness

   ___ Improper attitude

   ___ Other (Specify:) ______________________________

5. Please note any additional comments which you would like to make regarding apprentices:

   ____

   ____

APPENDIX D

STRUCTURED EMPLOYER INTERVIEW FORM

1. Are the apprentices being given training in high school on up-to-date equipment?

2. Do you think it is important for apprentices to have vocational training in high school prior to becoming an apprentice? Why?

3. Can you tell a difference in work performance between a student who had vocational training in high school vs. one who had a general or academic education? How?

4. If you could determine the criteria for selecting apprentices, what would you rate as the most important and maybe 2nd and 3rd?

5. What is your general impression of the apprenticeship program? Is it a good one? Is it cost effective? What improvements would you suggest?

6. Do you know if your co-workers had friends or relatives in the union prior to going into the union?

7. Would you have more apprentices if you could? Would you recommend that other employers do so?

8. Do you have any suggestions of ways to encourage apprentices who might be inclined to drop out of the program to stick with it?

9. From your experience, would you say that apprentices or the apprenticeship program has changed over the years? Have they improved?

Appendix E.1

Path Analysis for Machinists

Zero-order Correlations between Normalized Input Variables for Machinists

	1	2	3	4	5	6	7	8	9	10
1	1.000									
2	0.662	1.000								
3	0.648	0.932	1.000							
4	-0.130	-0.148	-0.137	1.000						
5	-0.195	-0.209	-0.18[illegible]	0.514	1.000					
6	-0.169	-0.190	-0.164	0.228	0.431	1.000				
7	0.025	-0.007	-0.033	0.058	0.059	-0.060	1.000			
8	-0.013	-0.068	-0.112	0.192	0.077	-0.010	0.288	1.000		
9	0.138	0.031	-0.003	0.022	-0.002	-0.039	0.130	0.064	1.000	
10	-0.020	-0.059	-0.044	0.083	0.111	0.062	0.040	0.172	0.246	1.000
11	-0.455	-0.295	-0.283	0.042	0.112	0.152	-0.047	-0.043	0.047	0.064
12	-0.087	-0.017	-0.012	0.033	0.096	0.038	-0.102	-0.143	0.111	0.030
13	-0.130	-0.133	-0.132	-0.003	0.042	0.003	-0.059	-0.032	0.057	0.057
14	-0.033	0.0	-0.031	0.060	-0.075	0.026	-0.086	-0.063	0.092	0.011
15	-0.196	-0.187	-0.189	0.110	0.059	0.080	0.121	0.052	-0.056	0.015
16	-0.118	-0.006	-0.050	-0.028	0.012	-0.014	0.033	0.035	0.047	0.010
17	-0.006	-0.013	-0.012	0.081	-0.038	-0.083	0.005	0.126	0.333	0.226
18	0.001	0.001	-0.029	0.064	-0.052	-0.063	0.110	0.138	0.177	0.145

	11	12	13	14	15	16	17	18
11	1.000							
12	0.209	1.000						
13	0.189	0.158	1.000					
14	0.063	0.109	0.053	1.000				
15	0.211	0.071	0.255	0.047	1.000			
16	0.205	0.128	0.103	0.008	0.338	1.000		
17	0.122	0.154	0.077	0.130	0.189	0.132	1.000	
18	0.115	0.130	0.093	0.127	0.294	0.225	0.823	1.000

1 - Age
2 - Dependents at application
3 - Dependents now
4 - Mother's education
5 - Father's education
6 - Father's occupation
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation
11 - Sources of useful information (H.S.)
12 - Hobbies in high school
13 - Clubs in high school
14 - Work experience in high school
15 - Program rating 1
16 - Program rating 2
17 - Self-rating in job
18 - Expected boss' rating

Appendix E.2

Path Analysis for Carpenters

Zero-order Correlations between Normalized Input Variables for Carpenters

	1	2	3	4	5	6	7	8	9	10
1	1.000									
2	0.225	1.000								
3	0.373	0.448	1.000							
4	0.056	-0.092	-0.162	1.000						
5	0.027	-0.085	-0.154	0.850	1.000					
6	0.048	-0.107	-0.107	0.436	0.451	1.000				
7	0.099	0.067	0.047	-0.134	-0.133	0.039	1.000			
8	0.122	0.098	0.023	-0.030	-0.030	0.092	0.394	1.000		
9	-0.037	0.025	-0.049	0.112	0.116	0.047	0.206	0.031	1.000	
10	-0.044	-0.065	-0.024	-0.031	-0.015	-0.084	0.215	0.260	0.234	1.000
11	-0.034	-0.002	0.017	-0.040	-0.080	-0.193	-0.015	-0.111	-0.070	-0.000
12	0.082	0.026	0.060	0.055	-0.009	-0.070	0.036	-0.014	-0.089	0.012
13	-0.122	-0.058	-0.112	-0.007	-0.069	-0.212	-0.109	-0.203	-0.063	-0.015
14	-0.110	-0.063	-0.124	0.069	-0.002	-0.149	-0.065	-0.131	0.031	0.091
15	-0.071	-0.012	-0.067	0.171	0.145	0.111	-0.018	-0.123	0.111	0.041
16	-0.170	-0.114	-0.126	0.015	-0.028	-0.044	-0.054	-0.090	0.095	-0.030
17	-0.020	-0.026	-0.037	-0.024	-0.038	-0.097	-0.122	0.123	-0.132	0.043
18	0.075	0.025	-0.009	0.099	0.055	0.072	0.030	0.029	0.078	0.099
19	-0.049	0.049	-0.027	0.139	0.196	0.089	0.156	0.187	0.285	0.315
20	-0.168	0.036	-0.054	0.071	0.127	0.048	0.151	0.142	0.271	0.293

	11	12	13	14	15	16	17	18	19	20
11	1.000									
12	0.391	1.000								
13	0.301	0.121	1.000							
14	0.215	0.177	0.686	1.000						
15	0.054	0.022	0.247	0.329	1.000					
16	0.109	-0.003	0.246	0.235	0.275	1.000				
17	0.038	0.013	-0.030	-0.036	-0.014	-0.031	1.000			
18	0.083	0.035	-0.037	0.013	0.074	0.025	0.229	1.000		
19	-0.028	0.001	0.041	0.148	0.236	0.097	0.128	0.175	1.000	
20	0.010	-0.017	0.070	0.122	0.215	0.089	0.176	0.171	0.849	1.000

Variables:

1 - Father's occupation
2 - Mother's education
3 - Father's education
4 - Dependents at application
5 - Dependents now
6 - Age
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation ability
11 - Clubs associated with high school
12 - Clubs outside of high school
13 - Hobbies in high school
14 - Hobbies after high school
15 - Relevant work experience
16 - Prior occupational training
17 - Program Rating 1
18 - Program Rating 2
19 - Self-rating of job performance
20 - Expected boss' rating

Appendix E.3

Path Analysis for Academic Curriculum Graduates

Zero-order Correlations between Normalized Input Variables for Academic Curriculum Graduates

	1	2	3	4	5	6	7	8	9	10
1	1.000									
2	0.525	1.000								
3	0.499	0.857	1.000							
4	-0.057	-0.102	-0.043	1.000						
5	-0.093	-0.213	-0.161	0.437	1.000					
6	-0.136	-0.155	-0.149	0.198	0.502	1.000				
7	0.079	-0.075	-0.016	0.091	-0.030	0.006	1.000			
8	0.080	0.002	0.031	0.037	-0.080	0.045	0.366	1.000		
9	0.096	0.208	0.189	0.062	-0.133	-0.088	0.145	0.118	1.000	
10	-0.097	-0.014	-0.009	0.001	0.006	-0.047	0.131	0.290	0.292	1.000
11	-0.284	-0.193	-0.201	-0.077	-0.052	0.015	0.030	-0.077	0.043	-0.031
12	-0.103	-0.062	-0.080	0.015	0.046	0.014	0.004	-0.128	0.067	0.056
13	-0.065	-0.067	-0.093	-0.027	0.089	0.072	-0.138	-0.073	-0.095	-0.170
14	0.007	0.052	-0.012	0.101	0.055	0.024	-0.059	-0.097	0.012	0.054
15	-0.006	-0.158	-0.152	-0.112	-0.072	0.068	0.096	0.146	-0.033	-0.060
16	0.147	0.105	0.114	-0.120	-0.054	-0.011	-0.003	0.050	0.047	-0.039
17	0.142	0.054	0.159	0.099	0.003	-0.015	0.203	0.192	0.216	0.220
18	0.139	0.030	0.114	0.049	-0.068	-0.066	0.234	0.190	0.237	0.222

	11	12	13	14	15	16	17	18
11	1.000							
12	0.218	1.000						
13	0.021	0.070	1.000					
14	-0.008	0.210	0.122	1.000				
15	0.154	0.062	0.061	0.147	1.000			
16	0.108	-0.003	0.082	0.109	0.455	1.000		
17	0.022	0.155	0.080	0.157	0.123	0.149	1.000	
18	0.034	0.159	0.055	0.148	0.209	0.187	0.893	1.000

Variables:

1 - Age
2 - Dependents at application
3 - Dependents now
4 - Mother's education
5 - Father's education
6 - Father's occupation
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation
11 - Sources of useful information (H.S.)
12 - Hobbies in high school
13 - Clubs in high school
14 - Work experience in high school
15 - Program rating 1
16 - Program rating 2
17 - Self-rating in job
18 - Expected boss' rating

Appendix E.4

Path Analysis for Vocational Curriculum Graduates

Zero-order Correlations between Normalized Input Variables for Vocational Curriculum Graduates

	1	2	3	4	5	6	7	8	9	10
1	1.000									
2	0.533	1.000								
3	0.539	0.905	1.000							
4	-0.159	-0.062	-0.102	1.000						
5	-0.239	-0.150	-0.188	0.430	1.000					
6	-0.080	-0.018	-0.034	0.170	0.253	1.000				
7	-0.021	-0.029	-0.087	-0.036	0.070	-0.011	1.000			
8	0.012	0.025	-0.046	0.099	0.042	-0.001	0.244	1.000		
9	-0.007	-0.003	-0.022	0.027	-0.030	-0.070	0.176	0.042	1.000	
10	-0.039	-0.073	-0.062	0.037	0.012	-0.005	0.123	0.173	0.284	1.000
11	-0.321	-0.200	-0.196	0.068	0.134	0.043	-0.033	-0.054	0.032	0.106
12	-0.347	-0.042	-0.034	-0.018	-0.054	-0.107	-0.037	-0.161	0.047	-0.016
13	-0.090	-0.050	-0.069	0.075	0.110	-0.012	0.014	-0.058	0.032	0.103
14	-0.151	-0.062	-0.120	0.122	0.042	-0.075	-0.105	-0.123	0.084	0.013
15	-0.119	-0.061	-0.070	0.169	0.153	0.081	-0.056	0.021	-0.131	0.138
16	-0.098	-0.015	-0.042	0.075	0.086	-0.056	0.038	0.002	0.031	0.100
17	0.031	0.061	0.087	0.072	0.001	-0.096	0.052	0.086	0.368	0.321
18	-0.025	0.021	0.055	0.104	0.011	-0.124	0.062	0.058	0.223	0.269

S

	11	12	13	14	15	16	17	18
11	1.000							
12	0.180	1.000						
13	0.213	0.284	1.000					
14	0.169	0.163	0.137	1.000				
15	0.140	-0.039	-0.003	-0.001	1.000			
16	0.183	0.009	0.087	-0.022	0.297	1.000		
17	0.054	0.047	0.023	0.033	0.161	0.148	1.000	
18	0.048	0.015	0.026	0.079	0.285	0.198	0.804	1.000

Variables:

1 - Age
2 - Dependents at application
3 - Dependents now
4 - Mother's education
5 - Father's education
6 - Father's occupation
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation
11 - Sources of useful information (H.S.)
12 - Hobbies in high school
13 - Clubs in high school
14 - Work experience in high school
15 - Program rating 1
16 - Program rating 2
17 - Self-rating in job
18 - Expected boss' rating

Appendix E.5

Path Analysis for General Curriculum Graduates

Zero-order Correlations between Normalized Input Variables for General Curriculum Graduates

	1	2	3	4	5	6	7	8	9	10
1	1.000									
2	0.510	1.000								
3	0.596	0.901	1.000							
4	-0.208	-0.223	-0.212	1.000						
5	-0.178	-0.213	-0.138	0.533	1.000					
6	-0.097	-0.074	-0.010	0.321	0.477	1.000				
7	-0.010	-0.086	-0.110	0.141	0.129	0.067	1.000			
8	-0.021	-0.118	-0.098	0.149	0.092	0.044	0.401	1.000		
9	0.149	0.083	0.102	-0.015	0.106	0.057	0.155	0.101	1.000	
10	-0.156	-0.031	0.043	-0.127	-0.007	0.002	0.088	0.222	0.083	1.000
11	-0.307	-0.120	-0.186	0.096	0.001	0.084	-0.026	-0.020	-0.045	0.182
12	-0.137	0.059	-0.034	0.078	0.069	0.154	-0.175	-0.115	-0.084	0.033
13	-0.180	-0.085	-0.139	-0.047	-0.073	-0.064	0.076	-0.106	-0.173	0.004
14	0.029	0.036	0.061	-0.113	-0.004	-0.068	0.034	-0.003	0.087	0.073
15	-0.198	-0.081	-0.067	0.087	-0.034	-0.017	0.004	0.107	-0.155	-0.013
16	0.008	-0.001	0.013	0.064	0.041	0.231	0.053	0.031	0.108	0.160
17	0.065	0.154	0.159	0.058	-0.033	-0.001	0.015	0.231	0.225	0.173
18	0.108	0.110	0.102	0.010	-0.038	-0.149	0.121	0.215	0.159	0.143

	11	12	13	14	15	16	17	18
11	1.000							
12	0.298	1.000						
13	0.193	0.195	1.000					
14	0.078	0.137	0.062	1.000				
15	0.207	0.139	0.132	-0.070	1.000			
16	0.026	0.145	0.136	0.141	0.181	1.000		
17	0.023	0.173	-0.087	0.059	0.200	0.235	1.000	
18	0.002	0.186	0.064	0.088	0.208	0.266	0.798	1.000

Variables:

1 - Age
2 - Dependents at application
3 - Dependents now
4 - Mother's education
5 - Father's education
6 - Father's occupation
7 - English grades
8 - Reading ability
9 - Apprenticeship grades
10 - Math computation
11 - Sources of useful information (H.S.)
12 - Hobbies in high school
13 - Clubs in high school
14 - Work experience in high school
15 - Program rating 1
16 - Program rating 2
17 - Self-rating in job
18 - Expected boss' rating

Appendix F.1

Path Analysis for Machinists

Standard Errors of Factor Loadings

	1	2	3	4	5	6	7	8	9
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.045	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.046	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.094	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.075	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.103	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.139	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.104	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.085	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.095	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.078	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.079	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.080	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.118	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.092	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.064
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.065

Standard Errors of Correlations between Factors

	1	2	3	4	5	6	7	8	9
1	0.0								
2	0.033	0.0							
3	0.066	0.067	0.0						
4	0.071	0.072	0.079	0.0					
5	0.093	0.094	0.096	0.103	0.0				
6	0.099	0.101	0.100	0.110	0.143	0.0			
7	0.082	0.085	0.090	0.099	0.127	0.135	0.0		
8	0.085	0.087	0.087	0.096	0.123	0.131	0.120	0.0	
9	0.067	0.068	0.067	0.074	0.095	0.102	0.090	0.088	0.0

Note. Variables defined in previous table.

Appendix F.2

Path Analysis for Carpenters

Standard Errors of Factor Loadings

	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.073	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.090	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.051	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.051	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.073	0.0	0.0	0.0	0.0	0.0	0.0	0.101
8	0.0	0.0	0.0	0.0	0.087	0.0	0.0	0.0	0.0	0.0	0.0	0.108
9	0.0	0.0	0.0	0.0	0.0	0.076	0.0	0.0	0.0	0.0	0.0	0.098
10	0.0	0.0	0.0	0.0	0.0	0.083	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.135	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.087	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.060	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.063	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.092	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.075	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.098	0.0	0.136
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.120	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.252	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.252	0.0

Standard Errors of Correlations between Factors

	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0											
2	0.058	0.0										
3	0.062	0.069	0.0									
4	0.059	0.067	0.044	0.0								
5	0.071	0.084	0.075	0.072	0.0							
6	0.095	0.110	0.098	0.095	0.107	0.0						
7	0.068	0.079	0.070	0.066	0.083	0.109	0.0					
8	0.064	0.075	0.068	0.062	0.078	0.105	0.070	0.0				
9	0.083	0.097	0.087	0.084	0.103	0.134	0.096	0.082	0.0			
10	0.093	0.108	0.097	0.094	0.115	0.149	0.107	0.133	0.133	0.0		
11	0.061	0.071	0.062	0.061	0.072	0.083	0.071	0.067	0.083	0.092	0.0	
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note. Variables defined in previous table.

Appendix F.3

Path Analysis for Academic Curriculum Graduates

Standard Errors of Factor Loadings

	1	2	3	4	5	6	7	8	9
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.055	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.057	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.135	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.087	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.087	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.099	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.091	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.100	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.096	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.099	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.094	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.095	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.191	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.102	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.061
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.059

Standard Errors of Correlations between Factors

	1	2	3	4	5	6	7	8	9
1	0.0								
2	0.048	0.0							
3	0.069	0.071	0.0						
4	0.065	0.069	0.082	0.0					
5	0.091	0.094	0.091	0.087	0.0				
6	0.101	0.103	0.102	0.096	0.129	0.0			
7	0.110	0.115	0.114	0.108	0.149	0.167	0.0		
8	0.066	0.073	0.069	0.064	0.093	0.099	0.119	0.0	
9	0.068	0.071	0.070	0.066	0.088	0.097	0.113	0.074	0.0

Note. Variables defined in previous table.

Appendix F.4

Path Analysis for Vocational Curriculum Graduates

Standard Errors of Factor Loadings

	1	2	3	4	5	6	7	8	9
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.054	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.053	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.148	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.085	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.128	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.118	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.091	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.087	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.099	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.091	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.091	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.091	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.132	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.103	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.065
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.066

Standard Errors of Correlations between Factors

	1	2	3	4	5	6	7	8	9
1	0.0								
2	0.046	0.0							
3	0.068	0.070	0.0						
4	0.089	0.088	0.111	0.0					
5	0.110	0.112	0.110	0.135	0.0				
6	0.104	0.105	0.104	0.126	0.163	0.0			
7	0.088	0.094	0.097	0.120	0.154	0.145	0.0		
8	0.096	0.099	0.099	0.124	0.154	0.145	0.137	0.0	
9	0.072	0.073	0.071	0.087	0.113	0.096	0.100	0.100	0.0

Note. Variables defined in previous table.

Appendix F.5

Path Analysis for General Curriculum Graduates

Standard Errors of Factor Loadings

	1	2	3	4	5	6	7	8	9
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.076	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.066	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.113	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.100	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.115	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.141	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.123	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.261	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.122	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.117	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.116	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.117	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.189	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.120	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.092
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.092

Standard Errors of Correlations between Factors

	1	2	3	4	5	6	7	8	9
1	0.0								
2	0.060	0.0							
3	0.090	0.084	0.0						
4	0.100	0.094	0.103	0.0					
5	0.113	0.104	0.113	0.126	0.0				
6	0.203	0.183	0.211	0.203	0.338	0.0			
7	0.113	0.112	0.127	0.143	0.156	0.278	0.0		
8	0.149	0.131	0.145	0.160	0.178	0.277	0.218	0.0	
9	0.096	0.089	0.097	0.109	0.116	0.269	0.134	0.169	0.0

Note. Variables defined in previous table.